



DEPARTMENT OF ENERGY

10 CFR Part 431

[EERE-2017-BT-STD-0021]

RIN 1904-AD90

Energy Conservation Program: Energy Conservation Standards for Unfired Hot Water Storage Tanks

AGENCY: Office of Energy Efficiency and Renewable Energy, Department of Energy.

ACTION: Notification of proposed determination and request for comment.

SUMMARY: The Energy Policy and Conservation Act, as amended (EPCA), prescribes energy conservation standards for various consumer products and certain commercial and industrial equipment, including unfired hot water storage tanks (UFHWSTs). EPCA also requires the U.S. Department of Energy (DOE or the Department) to periodically determine whether more-stringent, amended standards would result in significant additional conservation of energy, be technologically feasible, and be economically justified. After carefully considering the available market and technical information for this equipment, DOE has tentatively concluded in this document that it lacks clear and convincing evidence that more-stringent standards for UFHWSTs would save a significant additional amount of energy and would be economically justified. As such, DOE has initially determined that energy conservation standards for UFHWSTs do not

need to be amended. DOE requests comment on this notification of proposed determination (NOPD), as well as the associated analyses and results.

DATES: *Meeting:* DOE will hold a webinar on Tuesday, July 13, 2021, from 12:00 p.m. to 4:00 p.m. See section VII, “Public Participation,” for webinar registration information, participant instructions, and information about the capabilities available to webinar participants.

Comments: Written comments and information are requested and will be accepted on or before **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: Interested persons are encouraged to submit comments using the Federal eRulemaking Portal at <https://www.regulations.gov>. Follow the instructions for submitting comments. Alternatively, interested persons may submit comments by email to the following address: *UnfiredCommercialWH2017STD0021@ee.doe.gov*. Include docket number EERE-2017-BT-STD-0021 and/or RIN number 1904-AD90 in the subject line of the message. Submit electronic comments in WordPerfect, Microsoft Word, PDF, or ASCII file format, and avoid the use of special characters or any form of encryption. No telefacsimiles (faxes) will be accepted. For detailed instructions on submitting comments and additional information on this process, see section VII (Public Participation) of this document.

Although DOE has routinely accepted public comment submissions through a variety of mechanisms, including postal mail and hand delivery/courier, the Department has found it necessary to make temporary modifications to the comment submission process in light of the ongoing Covid-19 pandemic. DOE is currently accepting only electronic submissions at this time. If a commenter finds this change poses an undue hardship, please contact Appliance Standards Program staff at (202) 586-1445 to discuss the need for alternative arrangements. Once the Covid-19 pandemic health emergency is resolved, DOE anticipates resuming all of its regular options for public comment submissions, including postal mail and hand delivery/courier.

Docket: The docket for this activity, which includes *Federal Register* notices, public meeting attendee lists and transcripts, comments, and other supporting documents/materials, is available for review at <https://www.regulations.gov>. All documents in the docket are listed in the <https://www.regulations.gov> index. However, some documents listed in the index, such as information that is exempt from public disclosure, may not be publicly available.

The docket webpage can be found at:
<https://www.regulations.gov/docket?D=EERE-2017-BT-STD-0021>. The docket webpage contains instructions on how to access all documents, including public comments, in the docket. See section VII, “Public Participation,” for further information on how to submit comments through <https://www.regulations.gov>.

FOR FURTHER INFORMATION CONTACT: Ms. Catherine Rivest, U.S.

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For further information on how to submit a comment or review other public comments and the docket, contact the Appliance and Equipment Standards Program staff at (202) 287-1445 or by email: ApplianceStandardsQuestions@ee.doe.gov.

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I. Synopsis of the Proposed Determination

Title III, Part C¹ of EPCA,² established the Energy Conservation Program for Certain Industrial Equipment. (42 U.S.C. 6311-6317) This equipment includes UFHWSTs, the subject of this NOPD. (42 U.S.C. 6311(1)(K))

Pursuant to EPCA, DOE is triggered to consider amending the energy efficiency standards for certain types of commercial and industrial equipment, including the

¹ For editorial reasons, upon codification in the U.S. Code, Part C was redesignated Part A-1.

² All references to EPCA in this document refer to the statute as amended through the Energy Act of 2020, Pub. L. 116-260 (Dec. 27, 2020).

equipment at issue in this document, whenever the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) amends the standard levels or design requirements prescribed in ASHRAE Standard 90.1, “Energy Standard for Buildings Except Low-Rise Residential Buildings,” (ASHRAE Standard 90.1). Under a separate provision of EPCA, DOE is required to review the existing energy conservation standards for those types of covered equipment subject to ASHRAE Standard 90.1 every six 6 years to determine whether those standards need to be amended. (42 U.S.C. 6313(a)(6)(A)-(C)) DOE is conducting this review of the energy conservation standards for UFHWSTs under EPCA’s six-year-lookback authority. (42 U.S.C. 6313(a)(6)(C))

For this proposed determination, DOE analyzed UFHWSTs subject to standards as specified in the Code of Federal Regulations (CFR) at 10 CFR 431.110. DOE first analyzed the technological feasibility of more efficient UFHWSTs. For those UFHWSTs for which DOE determined higher standards to be technologically feasible, DOE estimated energy savings that would result from potential amended energy conservation standards. DOE also considered whether potential energy conservation standards would be economically justified. As discussed in the following sections, DOE has initially determined that it lacks clear and convincing evidence that amended energy conservation standards for UFHWSTs would result in significant additional conservation of energy or be economically justified.

Based on the results of these analyses, summarized in section V of this document, DOE has tentatively determined that current energy conservation standards for UFHWSTs do not need to be amended.

II. Introduction

The following section briefly discusses the statutory authority underlying this proposed determination, as well as some of the historical background relevant to the establishment of energy conservation standards for UFHWSTs.

A. Authority

EPCA, Pub. L. 94-163 (42 U.S.C. 6291-6317, as codified), among other things, authorizes DOE to regulate the energy efficiency of a number of consumer products and certain industrial equipment. Title III, Part C of EPCA, added by Pub. L. 95-619, Title IV, §441(a) (42 U.S.C. 6311–6317, as codified), established the Energy Conservation Program for Certain Industrial Equipment, which sets forth a variety of provisions designed to improve energy efficiency. This equipment includes UFHWSTs, the subject of this document. (42 U.S.C. 6311(1)(K))

Under EPCA, the energy conservation program consists essentially of four parts: (1) testing; (2) labeling; (3) the establishment of Federal energy conservation standards, and (4) certification and enforcement procedures. Relevant provisions of EPCA specifically include definitions (42 U.S.C. 6311), energy conservation standards (42 U.S.C. 6313), test procedures (42 U.S.C. 6314), labeling provisions (42 U.S.C. 6315), and the authority to require information and reports from manufacturers (42 U.S.C. 6316).

Federal energy conservation requirements for covered equipment established under EPCA generally supersede State laws and regulations concerning energy conservation testing, labeling, and standards. (42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297) DOE may, however, grant waivers of Federal preemption in limited circumstances for particular State laws or regulations, in accordance with the procedures and other provisions set forth under EPCA. (42 U.S.C. 6297(d); 42 U.S.C. 6316(a); 42 U.S.C. 6316(b)(2)(D))

Subject to certain criteria and conditions, DOE is required to develop test procedures to measure the energy efficiency, energy use, or estimated annual operating cost of covered equipment. (42 U.S.C. 6314) Specifically, EPCA requires that if a test procedure referenced in ASHRAE Standard 90.1 is updated, DOE must update its test procedure to be consistent with the amended test procedure in ASHRAE Standard 90.1, unless DOE determines, by rule, published in the *Federal Register* and supported by clear and convincing evidence, that the amended test procedure is not reasonably designed to produce test results that reflect the energy efficiency, energy use, or estimated operating costs of the covered ASHRAE equipment during a representative average use cycle. In addition, DOE must determine that the amended test procedure is not unduly burdensome to conduct. (42 U.S.C. 6314(a)(2) and (4)) In addition, if DOE determines that a test procedure amendment is warranted, it must publish proposed test procedures in the *Federal Register* and offer the public an opportunity (of not less than 45 days duration) to present oral and written comments on them. (42 U.S.C. 6314(b)) In contrast, if DOE determines that test procedure revisions are not appropriate, DOE must publish in the

Federal Register its determination not to amend the test procedures. (42 U.S.C.

6314(a)(1)(A)(ii))

Manufacturers of covered equipment must use the Federal test procedures as the basis for the following: (1) certifying to DOE that their equipment complies with the applicable energy conservation standards adopted pursuant to EPCA (42 U.S.C. 6316(b); 42 U.S.C. 6296), and (2) when making representations to the public regarding the energy use or efficiency of such equipment. (42 U.S.C. 6314(d)) Similarly, DOE uses these test procedures to determine whether the equipment complies with relevant standards promulgated under EPCA. It is noted that DOE does not prescribe a test procedure for UFHWSTs, as the current Federal standard is an insulation design requirement of a minimum R-value of R-12.5. 10 CFR 431.110.

EPCA contains mandatory energy conservation standards for commercial heating, air-conditioning, and water-heating equipment. (42 U.S.C. 6313(a)) Specifically, the statute sets standards for small, large, and very large commercial package air conditioning and heating equipment, packaged terminal air conditioners and packaged terminal heat pumps, warm-air furnaces, packaged boilers, storage water heaters, instantaneous water heaters, and UFHWSTs. *Id.* In doing so, EPCA established Federal energy conservation standards that generally corresponded to the levels in the ASHRAE Standard 90.1 in effect on October 24, 1992 (*i.e.*, ASHRAE Standard 90.1-1989).

If ASHRAE Standard 90.1 is amended with respect to the standard levels or design requirements applicable under that standard for certain commercial equipment,

including UFHWSTs, not later than 180 days after the amendment of the standard, DOE must publish in the *Federal Register* for public comment an analysis of the energy savings potential of amended energy efficiency standards. (42 U.S.C. 6313(a)(6)(A)(i)) DOE must adopt amended energy conservation standards at the new efficiency level in ASHRAE Standard 90.1, unless clear and convincing evidence supports a determination that adoption of a more-stringent efficiency level as a national standard would produce significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii))

To determine whether a standard is economically justified, EPCA requires that DOE determine whether the benefits of the standard exceed its burdens by considering, to the greatest extent practicable, the following seven factors:

- (1) The economic impact of the standard on manufacturers and consumers of the products subject to the standard;
- (2) The savings in operating costs throughout the estimated average life of the product in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses of the products likely to result from the standard;
- (3) The total projected amount of energy savings likely to result directly from the standard;
- (4) Any lessening of the utility or the performance of the products likely to result from the standard;

- (5) The impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from the standard;
- (6) The need for national energy conservation; and
- (7) Other factors the Secretary considers relevant.

(42 U.S.C. 6313(a)(6)(B)(ii) and (C)(i); 42 U.S.C. 6316(a); 42 U.S.C.

6295(o)(2)(B)(i))

If DOE adopts as a national standard the efficiency levels specified in the amended ASHRAE Standard 90.1, DOE must establish such a standard not later than 18 months after publication of the amended industry standard. (42 U.S.C.

6313(a)(6)(A)(ii)(I)) If DOE determines that a more-stringent standard is appropriate under the statutory criteria, DOE must establish the more-stringent standard not later than 30 months after publication of the revised ASHRAE Standard 90.1. (42 U.S.C.

6313(a)(6)(B)(i))

EPCA also requires that every six years DOE shall evaluate the energy conservation standards for each class of certain covered commercial equipment, including UFHWSTs, and publish either a notice of determination that the standards do not need to be amended, or a notice of proposed rulemaking (NOPR) that includes new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6313(a)(6)(C)(i)) EPCA further provides that, not later than three years after the issuance of a final determination not to amend standards, DOE must publish either a notice of determination that standards for the product do not need to be amended, or a

NOPR including new proposed energy conservation standards (proceeding to a final rule, as appropriate). (42 U.S.C. 6313(a)(6)(C)(iii)(II)) DOE must make the analysis on which the determination is based publicly available and provide an opportunity for written comment. (42 U.S.C. 6313(a)(6)(C)(ii)) Further, a determination that more-stringent standards would: (1) result in significant additional conservation of energy and (2) be both technologically feasible and economically justified must be supported by clear and convincing evidence. (42 U.S.C. 6313(a)(6)(C)(i); 42 U.S.C. 6313(a)(6)(A)) DOE is publishing this NOPD in satisfaction of the 6-year review requirement in EPCA, having initially determined that DOE lacks clear and convincing evidence that amended standards for UFHWSTs would result in significant additional conservation of energy and be economically justified.

B. Background

1. Current Standards

The initial Federal standards for UFHWSTs, established by EPCA, corresponded to the efficiency levels contained in ASHRAE Standard 90.1-1989. On January 12, 2001, DOE amended the standards for UFHWSTs to be equivalent to the efficiency level in ASHRAE Standard 90.1 as revised in October 1999. 66 FR 3336 (January 2001 final rule). The January 2001 final rule established an insulation design requirement of a minimum R-value of R-12.5 for all UFHWSTs. 66 FR 3336, 3356 (Jan. 12, 2001). This remains the current Federal standard (and the standard level specified in the most recent version of ASHRAE Standard 90.1). The current standard is located at 10 CFR 431.110.

2. History of Standards Rulemakings for UFHWSTs

As noted previously, the standards for UFHWSTs were most recently amended in the January 2001 final rule. EPCA requires DOE to evaluate the applicable energy conservation standard for UFHWSTs every 6 years to determine whether it needs to be amended. (42 U.S.C. 6313(a)(6)(C)(i)) Thus, DOE published a request for information (RFI) on August 9, 2019, which identified various issues and sought to collect data and information to inform its determination, consistent with its obligations under EPCA, as to whether the UFHWST standards need to be amended (the August 2019 RFI). 84 FR 39220.

DOE received five comments in response to the August 2019 RFI from the interested parties listed in Table II.1. Discussion of the relevant comments provided by these organizations and DOE's responses are provided in the appropriate sections of this document.

Table II.1 Interested Parties Providing Written Comments on the August 2019 RFI

Name	Abbreviation	Commenter Type
Appliance Standards Awareness Project and Natural Resources Defense Council	ASAP and NRDC	Efficiency Organizations
Air-Conditioning, Heating, & Refrigeration Institute	AHRI	Trade Association
Pacific Gas and Electric Company (PG&E), Sand Diego Gas and Electric (SDG&E), Southern California Edison (SCE)	CA IOUs	Investor-Owned Utilities
A.O. Smith Corporation	A.O. Smith	Manufacturer
Bradford White Corporation	BWC	Manufacturer

A parenthetical reference at the end of a comment quotation or paraphrase provides the location of the item in the public record.³

III. General Discussion

DOE developed this proposed determination after a review of the UFHWST market, including product literature and product listings in the DOE Compliance Certification Management System (CCMS) database. DOE also considered written comments, data, and information from interested parties that represent a variety of interests. This notice addresses issues raised by these commenters.

A. Product Classes and Scope of Coverage

When evaluating and establishing new or amended energy conservation standards, DOE typically divides covered equipment into equipment classes by the type of energy used or by capacity or other performance-related features that justify differing standards. For UFHWSTs, the current standard at 10 CFR 431.110 is applicable to a single equipment class covering all UFHWSTs, which is consistent with the standard and structure in ASHRAE Standard 90.1. DOE's regulations define "unfired hot water storage tank" as a tank used to store water that is heated externally, and that is industrial

³ The parenthetical reference provides a reference for information located in the docket. (Docket No. EERE-2017-BT-STD-0021, which is maintained at <https://www.regulations.gov/docket?D=EERE-2017-BT-STD-0021>). The references are arranged as follows: (commenter name, comment docket ID number, page of that document).

equipment. 10 CFR 431.102. The scope of coverage is discussed in further detail in section IV.A.1 of this NOPD.

B. Test Procedure

EPCA sets forth generally applicable criteria and procedures for DOE's adoption and amendment of test procedures. (42 U.S.C. 6314(a)) As a general matter, manufacturers of covered ASHRAE equipment must use these test procedures to certify to DOE that their equipment complies with energy conservation standards and to quantify the efficiency of their equipment. (42 U.S.C. 6316(b); 42 U.S.C. 6296) DOE's current energy conservation standards for UFHWSTs are expressed in terms of a minimum R-value for tank insulation. (*See* 10 CFR 431.110.)

DOE does not prescribe a test procedure for UFHWSTs; however, DOE's regulations define "R-value" as the thermal resistance of insulating material as determined using either ASTM International (ASTM) C177-13, "Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus," or ASTM C518-15, "Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus" and expressed in ($^{\circ}\text{F ft}^2 \text{ h/Btu}$). 10 CFR 431.102.

In response to the August 2019 RFI, DOE received several comments encouraging DOE to consider a performance-based test procedure for UFHWSTs. ASAP and NRDC referenced a test procedure notice of proposed rulemaking (NPR) published in the *Federal Register* on May 9, 2016 (81 FR 28588) (May 2016 CWH TP NPR) in

which DOE proposed, among other things, a standby loss test for UFHWSTs, and a final rule for the test procedure for commercial water heating (CWH) equipment published in the *Federal Register* on November 10, 2016 (81 FR 79261), in which DOE suggested that it would address comments received in response to the May 2016 CWH TP NOPR in a separate rulemaking notice. These commenters encouraged DOE to review and finalize the performance-based test procedure for UFHWSTs before proceeding with a UFHWST standards rulemaking, in order to not forgo potential additional energy savings that could come from incorporating standby losses and/or other changes to the UFHWST test procedure. (ASAP and NRDC, No. 7 at pp. 1-2) Similarly, the CA IOUs stated that they believe the current R-12.5 insulation requirement limits consumer choice and does not encourage design innovation. They likewise encouraged DOE to adopt a performance-based metric, which they believe would lead to additional energy savings. The CA IOUs analyzed standby losses for commercial storage water heaters in the AHRI Directory of Certified Product Performance and noted a wide range of performance. They stated that this suggests the potential for energy savings opportunities for UFHWSTs, if storage water heater tanks are representative of UFHWSTs. Commenting more specifically, the CA IOUs encouraged DOE to consider the thermal losses through uninsulated ports. (CA IOUs, No. 3 at pp. 1-3)

In contrast to these comments, BWC recommended that DOE maintain the requirements for UFHWSTs in terms of insulation level, stating that performance testing for UFHWSTs would be overly burdensome, especially considering the relatively small and customized nature of the marketplace. BWC also expressed concerns that a test procedure change, and ultimately an energy conservation standards change, could have

anti-competitive impacts on the UFHWST market. (BWC, No. 5 at pp. 1-3) AHRI also recommended maintaining the current prescriptive design requirement (a minimum insulation requirement of R-12.5), rather than a performance-based metric, stating that the prescriptive approach is simpler. (AHRI, No. 6 at p. 2)

As discussed in section II.A of this document, DOE is publishing this NOPD in satisfaction of the 6-year-lookback review requirement in EPCA, which requires DOE to evaluate the energy conservation standards for certain commercial equipment, including UFHWSTs. Under that provision, DOE must publish either a notice of determination that the standards do not need to be amended, or a NOPR that includes proposed amendments to the energy conservation standards (proceeding to a final rule, as appropriate) every six years. (42 U.S.C. 6313(a)(6)(C)(i)) Because test procedure amendments to adopt a standby loss requirement were not finalized for UFHWSTs, for this analysis of potential amended standards, DOE has only considered potential amended standards based on updating the prescriptive design requirement for insulation R-value.

C. Technological Feasibility

1. General

In evaluating potential amendments to energy conservation standards, DOE first conducts a market and technology assessment to survey all current technology options in products on the market and prototype designs that could improve the efficiency of the products or equipment that are the subject of the determination. This list of technology options for consideration is developed in consultation with manufacturers, design engineers, and other interested parties. DOE then conducts a screening analysis for the

technologies identified, and, as a first step, determines which of those means for improving efficiency are technologically feasible. DOE considers technologies incorporated in commercially available equipment or in working prototypes to be technologically feasible. *See generally* 10 CFR 431.4; 10 CFR part 430, subpart C, appendix A, section 6(c)(3)(i) and 7(b)(1).

After DOE has determined that particular technology options are technologically feasible, it further evaluates each technology option in light of the following additional screening criteria: (1) practicability to manufacture, install, and service; (2) adverse impacts on equipment utility or availability; (3) adverse impacts on health or safety; and (4) unique-pathway proprietary technologies. *See generally* 10 CFR 431.4; 10 CFR part 430, subpart C, appendix A, sections 6(c)(3)(ii)-(v) and 7(b)(2)-(5). Section IV.A.3 of this document discusses the results of the screening analysis for UFHWSTs, particularly the designs DOE considered, those it screened out, and those that are the basis for the standards considered in this proposed determination.

2. Maximum Technologically Feasible Levels

When DOE proposes to adopt an amended standard for a type or class of covered equipment, as part of its analysis, the Department determines the maximum improvement in energy efficiency or maximum reduction in energy use that is technologically feasible for such equipment. Accordingly, in the engineering analysis, DOE determined the maximum technologically feasible (max-tech) improvements in energy efficiency for UFHWSTs, using the design parameters for the most efficient equipment available on the

market or in working prototypes. The max-tech levels that DOE determined for this analysis are described in section IV.B of this proposed determination.

D. Energy Savings

1. Determination of Savings

For each efficiency level (EL) evaluated, DOE projected energy savings from application of the EL to the UFHWSTs purchased in the 30-year period that begins in the assumed year of compliance with the potential amended standards (2025–2054). The savings are measured over the entire lifetime of the UFHWSTs purchased in the previous 30-year period. DOE quantified the energy savings attributable to each EL as the difference in energy consumption between each standards case and the no-new-standards case. The no-new-standards case represents a projection of energy consumption that reflects how the market for equipment would likely evolve in the absence of amended energy conservation standards. DOE used a simplified National Impacts Analysis (NIA) spreadsheet model to estimate national energy savings (NES) from potential amended or new standards for UFHWSTs. The simplified NIA for this analysis is to ascertain if potential efficiency improvements for UFHWSTs meet the required significance of savings described in section III.D.2 of this document; however, it does not estimate the net present value (NPV) to the Nation of these savings that is typically performed as part of the NIA. The simplified NIA spreadsheet model (described in section IV.F of this document) calculates energy savings in terms of site energy, which is the energy directly consumed by equipment at the locations where it is used.

2. Significance of Savings

In determining whether amended standards are needed for covered equipment addressed by ASHRAE Standard 90.1, DOE must consider whether such standards would result in significant additional conservation of energy.⁴ (42 U.S.C. 6313(a)(6)(C)(i); 42 U.S.C. 6313(a)(6)(A)(ii)(II))

EPCA defines “energy efficiency” as the ratio of the useful output of services from an article of industrial equipment to the energy use of such article, measured according to the Federal test procedures. (42 U.S.C. 6311(3)) EPCA defines “energy use” as the quantity of energy directly consumed by an article of industrial equipment at the point of use, as measured by the Federal test procedures. (42 U.S.C. 6311(4)) Given this context, DOE relies on site energy as the appropriate metric for evaluating the significance of energy savings.

E. Economic Justification

1. Specific Criteria

As noted previously, EPCA provides seven factors to be considered in determining whether a potential energy conservation standard is economically justified.

⁴ In setting a more-stringent standard for ASHRAE equipment, DOE must have “clear and convincing evidence” that doing so “would result in significant additional conservation of energy,” in addition to being technologically feasible and economically justified. 42 U.S.C. 6313(a)(6)(A)(ii)(II). This language indicates that Congress had intended for DOE to ensure that, in addition to the savings from the ASHRAE standards, DOE’s standards would yield additional energy savings that are significant. In DOE’s view, this statutory provision shares the requirement with the statutory provision applicable to other covered non-ASHRAE equipment that “significant conservation of energy” must be present (42 U.S.C. 6295(o)(3)(B); 42 U.S.C. 6316(a)), but it must also be supported with “clear and convincing evidence” to permit DOE to set a more stringent requirement than ASHRAE.

(42 U.S.C. 6313(a)(6)(B)(ii)(I)-(VII)) The following sections provide an overview of each of those seven factors.

a. Economic Impact on Manufacturers and Consumers

In determining the impacts of a potential amended standard on manufacturers, DOE typically conducts a manufacturer impact analysis (MIA). In conducting a MIA, DOE uses an annual cash-flow approach to compare the quantitative impacts between the no-new-standards and the amended standards cases. The industry-wide impacts typically analyzed include: (1) industry net present value (INPV), which values the industry on the basis of expected future cash flows; (2) cash flows by year; (3) changes in revenue and income, and (4) other measures of impact, as appropriate. However, DOE is not proposing amended standards for UFHWSTs, and, therefore, this proposed determination would have no cash-flow impacts on manufacturers. Accordingly, as discussed further in section IV.G of this document, DOE did not conduct an MIA for this NOPD.

For individual consumers, measures of economic impact include the changes in the life-cycle cost (LCC) and payback period (PBP) associated with new or amended standards. These measures are discussed further in the following section. For consumers in the aggregate, DOE also typically calculates the national net present value of the consumer costs and benefits expected to result from particular standards. DOE also typically evaluates the impacts of potential standards on identifiable subgroups of consumers that may be affected disproportionately by a standard. However, as discussed in section V.A.2 of this document, due to significant uncertainties regarding the costs of alterations to doorways and mechanical rooms (which may be required in certain

replacement installations in order to get an UFHWST to its installation destination if additional insulation thickness makes the UFHWST too large for existing structures to accommodate) and the lack of data indicating the likelihood of such alterations being required, any analysis conducted by DOE regarding the LCC or PBP would be of limited value because of the lack of data and high degree of uncertainty of the inputs to those analyses. Therefore, DOE did not estimate the NPV of consumer costs and benefits.

b. Savings in Operating Costs Compared to Increase in Price (LCC and PBP)

EPCA requires DOE to consider the savings in operating costs throughout the estimated average life of the covered product in the type (or class) compared to any increase in the price of, or in the initial charges for, or maintenance expenses of, the covered product that are likely to result from a standard. (42 U.S.C. 6313(a)(6)(B)(ii)(II)) DOE typically conducts this comparison in its LCC and PBP analysis.

The LCC is the sum of the purchase price of equipment (including its installation) and the operating expense (including energy, maintenance, and repair expenditures) discounted over the lifetime of the equipment. The LCC analysis requires a variety of inputs, such as equipment prices, energy consumption, energy prices, maintenance and repair costs, equipment lifetime, and discount rates appropriate for consumers. To account for uncertainty and variability in specific inputs, such as equipment lifetime and discount rate, DOE uses a distribution of values, with probabilities attached to each value.

The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of more-efficient equipment through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost due to a more-stringent standard by the change in annual operating cost for the year that standards are assumed to take effect. This type of calculation is known as a “simple” payback period because it does not take into account changes in operating expenses over time or the time value of money (*i.e.*, the calculation is done at an effective discount rate of zero percent). Payback periods greater than the life of the equipment indicate that the increased total installed cost is not recovered by the reduced operating expenses.

For its LCC and PBP analysis, DOE assumes that consumers will purchase the equipment in the first year of compliance with new or amended standards. The LCC savings for the considered efficiency levels are calculated relative to the case that reflects projected market trends in the absence of new or amended standards. As discussed in section IV.D of this document, DOE did not conduct an LCC and PBP analysis for this NOPD because the lack of data and high degree of uncertainty of the inputs to those analyses meant that the outputs would be of little value.

c. Energy Savings

Although significant conservation of energy is a separate statutory requirement for amending an energy conservation standard, EPCA requires DOE, in determining the economic justification of a standard, to consider the total projected energy savings that are expected to result directly from the standard. (42 U.S.C. 6313(a)(6)(B)(ii)(III)) As

discussed in section IV.F of this document, DOE uses the NIA spreadsheet models to project national energy savings.

d. Lessening of Utility or Performance of Equipment

In establishing equipment classes and in evaluating design options and the impact of potential standard levels, DOE evaluates potential standards that would not lessen the utility or performance of the considered products. (42 U.S.C. 6313(a)(6)(B)(ii)(IV)) Because DOE is not proposing standards for UFHWSTs, the Department has tentatively concluded that this proposed determination would not reduce the utility or performance of UFHWSTs.

e. Impact of Any Lessening of Competition

EPCA directs DOE to consider the impact of any lessening of competition, as determined in writing by the Attorney General, that is likely to result from a proposed standard. (42 U.S.C. 6313(a)(6)(B)(ii)(V)) Because DOE is not proposing standards for UFHWSTs, DOE did not transmit a copy of its proposed determination to the Attorney General for anti-competitive review.

f. Need for National Energy Conservation

DOE also considers the need for national energy conservation in determining whether a new or amended standard is economically justified. (42 U.S.C. 6313(a)(6)(B)(ii)(VI)) Because DOE has tentatively concluded that it lacks clear and convincing evidence that amended standards for UFHWSTs would result in significant

additional conservation of energy or be economically justified, DOE did not conduct a utility impact analysis or emissions analysis for this NOPD.

g. Other Factors

In determining whether an energy conservation standard is economically justified, DOE may consider any other factors that the Secretary deems to be relevant. (42 U.S.C. 6313(a)(6)(B)(ii)(VII)) To the extent DOE identifies any relevant information regarding economic justification that does not fit into the other categories described previously, DOE could consider such information under “other factors.”

IV. Methodology and Discussion of Related Comments

This section addresses DOE’s consideration of the statutory factors and the analyses that DOE has performed for this proposed determination with regard to UFHWSTs. Separate subsections address each component of the factors for DOE’s consideration, as well as corresponding analyses to the extent conducted. DOE used a spreadsheet tool to estimate the impact of potential energy conservation standards. This spreadsheet uses inputs from the energy use analysis and shipments projections and calculates a simplified NES expected to result from potential energy conservation standards.

A. Market and Technology Assessment

DOE develops information in the market and technology assessment that provides an overall picture of the market for the equipment concerned, including the purpose of

the equipment, the industry structure, manufacturers, market characteristics, and technologies used in the equipment. This activity includes both quantitative and qualitative assessments, based primarily on publicly-available information. DOE also conducted structured, detailed interviews with representative manufacturers. During these interviews, DOE discussed engineering, manufacturing, procurement, and financial topics to validate assumptions used in its analyses, and to identify key issues or concerns. These interviews were conducted under non-disclosure agreements (NDAs), so DOE does not document these discussions in the same way that it does public comments in the comment summaries and DOE's responses throughout the rest of this document.

The subjects addressed in the market and technology assessment for this proposed determination include: (1) a determination of the scope and equipment classes; (2) manufacturers and industry structure; (3) shipments information, (4) market and industry trends, and (5) technologies or design options that could improve the energy efficiency of UFHWSTs. The key findings of DOE's market assessment are summarized in the following subsections.

1. Scope of Coverage and Equipment Classes

In this analysis, DOE relied on the definition of UFHWSTs in 10 CFR 431.102, which defines an UFHWST as a tank used to store water that is heated externally, and that is industrial equipment. Any equipment meeting the definition of an UFHWST is included in DOE's scope of coverage. UFHWSTs are not currently divided into equipment classes (*i.e.*, there is a single equipment class covering all UFHWSTs).

In the August 2019 RFI, DOE requested comment on whether the current definition of UFHWSTs requires any revisions, and whether any sub-category divisions should be added. 84 FR 39220, 39224 (August 9, 2019). In response, BWC generally supported the definition of UFHWSTs as presented in the August 2019 RFI (*i.e.*, the current regulatory definition). Similarly, BWC also stated that it does not believe any subcategory definitions should be created and that there is not an appropriate way to divide UFHWSTs into separate equipment classes. (BWC, No. 5 at pp. 1-2) The CA IOUs encouraged DOE to ensure that any revised definitions of UFHWSTs maintain the current scope of coverage, and suggested that DOE should not consider establishing new equipment classes that are not currently available in the market. The CA IOUs also recommended that equipment class differentiations should be based on performance-related features that are “accessible to the layperson and is based on user operation.”⁵ (CA IOUs, No. 3 at pp. 1-3)

In this proposed determination, absent any indication that the scope of UFHWSTs as currently defined would benefit from amendment, DOE is not proposing any changes to the definition of UFHWSTs. Similarly, because DOE does not have an indication that capacity or other performance characteristic justifies a different standard level, and because commenters did not provide any such indication, DOE is not proposing to divide UFHWSTs into separate equipment classes in this NOPD. Therefore, the analysis for

⁵ The terminology “accessible to the layperson and is based on user operation” used by CA IOUs is quoted from a discussion of product utility written by DOE in the context of differentiating product classes in a March 12, 2015 notice of proposed rulemaking for energy conservation standards for residential non-weatherized gas furnaces and mobile home furnaces. 80 FR 13120, 13137. The full document is available at: <https://www.regulations.gov/document?D=EERE-2014-BT-STD-0031-0032> (Last accessed: July 22, 2020).

this NOPD was conducted for the existing single equipment class covering all UFHWSTs.

2. Technology Options

In the August 2019 RFI, DOE identified several technology options that would be expected to improve the efficiency of UFHWSTs. 84 FR 39220, 39225 (August 9, 2019). These technology options were based on manufacturer equipment literature and publicly-available technical literature. Specifically, the technologies identified in the August 2019 RFI included the following:

- Improved insulation R-value
 - Increased insulation thickness
 - Foam insulation
 - Advanced insulation types
 - Aerogel
 - Vacuum panels
 - Inert gas-filled panels
- Pipe and fitting insulation
- Greater coverage of tank surface area with foam insulation (*e.g.*, tank bottom)

3. Screening Analysis

DOE uses the following five screening criteria to determine which technology options are suitable for further consideration in an energy conservation standards rulemaking:

(1) *Technological feasibility.* Technologies that are not incorporated in commercial equipment or in working prototypes will not be considered further.

(2) *Practicability to manufacture, install, and service.* If it is determined that mass production and reliable installation and servicing of a technology in commercial equipment could not be achieved on the scale necessary to serve the relevant market at the time of the projected compliance date of the standard, then that technology will not be considered further.

(3) *Impacts on equipment utility or equipment availability.* If it is determined that a technology would have significant adverse impact on the utility of the equipment to significant subgroups of consumers or would result in the unavailability of any covered equipment type with performance characteristics (including reliability), features, sizes, capacities, and volumes that are substantially the same as equipment generally available in the United States at the time, it will not be considered further.

(4) *Adverse impacts on health or safety.* If it is determined that a technology would have significant adverse impacts on health or safety, it will not be considered further.

(5) *Unique-Pathway Proprietary Technologies*. If a design option utilizes proprietary technology that represents a unique pathway to achieving a given efficiency level, that technology will not be considered further.

10 CFR part 430, subpart C, appendix A, sections 6(c)(3) and 7(b). In summary, if DOE determines that a technology, or a combination of technologies, fails to meet one or more of the listed five criteria, it will be excluded from further consideration in the engineering analysis.

a. Screened-Out Technologies

In response to the August 2019 RFI, DOE received several comments related to the suggested technology options. A.O. Smith stated that the technologies used to increase the efficiency of UFHWSTs are limited to changes in installation thickness, location, and materials. (A.O. Smith, No. 8 at p. 2) BWC stated that many of the technologies listed would be very difficult to apply to UFHWSTs due to the wide variety of tank sizes, configurations, and fittings. Additionally, BWC stated that the majority of the technologies identified would present significant manufacturability issues due to the variability of tank configurations and fittings, and that increasing insulation thickness and/or changing to another insulating solutions could present issues with fittings that would not occur otherwise. BWC also asserted that the technology options listed could increase the fragility of tanks, which could cause difficulties in moving the tanks to their final installation location. (BWC, No. 5 at p. 2) As discussed in section IV.A of this document, DOE also conducted interviews with manufacturers. During these interviews,

which were conducted under NDAs, manufacturers made statements similar to those comments submitted by BWC in response to the August 2019 RFI.

In response to these comments, DOE acknowledges that requiring use of advanced insulation types (such as vacuum panels or aerogels) could necessitate an extremely difficult change to the UFHWST manufacturing process due to the rigid nature of these materials and the high degree of customization and ports on UFHWSTs. Applying these materials closely around ports and configuring them to all tank shapes and setups (*e.g.*, number of ports, port locations) may not be possible where tight curvatures would be required and/or due to the high level of customization of UFHWSTs. Additionally, DOE is not aware of equipment on the market that incorporate aerogels, vacuum panels, or inert gas-filled panels at the time of this analysis. Therefore, in the analysis for this NOPD, DOE did not consider any advanced insulation types as a technology option to increase the insulation R-value for UFHWSTs.

To explain what technologies are commonly used, BWC stated that most manufacturers use polyurethane foam to achieve the minimum R-12.5 requirement, although high density fiberglass may be applied in certain areas where it is difficult to apply foam. (BWC, No. 5 at p. 2) Relatedly, A.O. Smith stated that certain technology options proposed by DOE, such as insulation on tank bottoms, would be impractical to implement because bottom mounted drain connections must be kept accessible. (A.O. Smith, No. 8 at p. 2) AHRI commented that technologies such as pipe insulation cannot be pre-configured by the manufacturer for installation in the field. (AHRI, No. 6 at p. 2)

As suggested by BWC, and supported by DOE's review of publicly-available manufacturer information, polyurethane foam is the most commonly used type of insulation for meeting the minimum insulation requirement, but fiberglass and/or Styrofoam are often used in specific regions (e.g. tank tops or bottoms, or regions around ports) where doing so could limit access to ports or be impractical to manufacture. For its analyses, DOE has estimated energy losses based on tanks being covered primarily with polyurethane foam, but the agency has also included several regions with alternative insulation materials. Therefore, DOE included a minimum amount of insulation around pipes and fittings in its analysis of baseline equipment, but it did not consider requiring different insulation materials in these regions. Likewise, DOE did not consider additional insulation coverage around pipes and fittings as a technology option for the analysis.

b. Remaining Technologies

Ultimately, after reviewing all of the proposed technologies, DOE did not screen out improved insulation R-value due to increased polyurethane foam thickness, so the Department included this as a design option in the engineering analysis. DOE determined that this technology option is technologically feasible because it only involves an increase in thickness of the same insulation material that is currently commonly used on UFHWSTs, and can be achieved with the same processes that are currently being used in commercially-available equipment or working prototypes (e.g., fabricating jackets or foaming).

B. Engineering Analysis

The purpose of the engineering analysis is to establish the relationship between the efficiency and cost of UFHWSTs at different levels of reduced heat loss (“efficiency levels”).⁶ This relationship serves as the basis for the cost-benefit calculations for commercial consumers, manufacturers, and the Nation. There are typically two elements to consider in the engineering analysis; the selection of efficiency levels to analyze (*i.e.*, the “efficiency analysis”) and the determination of equipment cost at each efficiency level (*i.e.*, the “cost analysis”). In determining the performance of higher-efficiency equipment, DOE considers technologies and design option combinations not eliminated by the screening analysis. DOE then typically estimates the manufacturing production cost (MPC) at the baseline and the change in MPC associated with reducing the heat loss of equipment above the baseline, up to the max-tech efficiency level for each equipment class. The typical output of the engineering analysis is a set of cost-efficiency “curves” that are used in downstream analyses (*i.e.*, the LCC and PBP analyses and the NIA). However, for the reasons discussed in IV.B.3 of this document, the cost analysis was not performed for this NOPD.

1. Efficiency Levels for Analysis

DOE typically uses one of two approaches to develop energy efficiency levels for the engineering analysis: (1) relying on observed efficiency levels in the market (*i.e.*, the efficiency-level approach), or (2) determining the incremental efficiency improvements associated with incorporating specific design options to a baseline model (*i.e.*, the design-option approach). Using the efficiency-level approach, the efficiency levels established

⁶ While the UFHWSTs standard addresses heat loss through establishing a minimum level of insulation, for the purpose of this analysis, the levels of improvement are referred to generally as “efficiency levels.”

for the analysis are determined based on the market distribution of existing equipment (in other words, based on the range of efficiencies and efficiency level “clusters” that already exist on the market, without regard to the specific design options used to achieve those levels). Using the design-option approach, the efficiency levels established for the analysis are determined through detailed engineering calculations and/or computer simulations of the efficiency improvements resulting from implementation of specific design options that have been identified in the technology assessment. DOE may also rely on a combination of these two approaches. In this rulemaking, DOE is adopting a design-option approach because there are very few models of UFHWSTs currently on the market that are marketed with higher insulation levels than the current baseline requirement of R-12.5.

Based on its review of publicly-available equipment information and feedback from manufacturers, DOE had tentatively determined that 2 inches of polyurethane foam insulation is needed to meet the current insulation requirement, and DOE, therefore, considered this insulation thickness as the baseline. As discussed in section IV.A.3 of this document, increased polyurethane foam insulation thickness was the only technology option that was not screened-out for this analysis, and thus, DOE considered more-stringent efficiency levels (*i.e.*, increased R-value) based on varying levels of increased polyurethane foam thickness.

In response to the August 2019 RFI, AHRI commented that there is a diminishing return from increasing insulation thickness due to the increasing heat transfer rate and surface area as the insulation thickness increases. (AHRI, No. 6 at pp. 1-2) This

comment was supported by individual manufacturers during interviews with DOE. Manufacturers stated that surface tension decreases as the foam thickness increases, which results in the foam becoming less stable. To counter this, less blowing agent is used and the foam becomes denser, thereby reducing the added insulating benefit per inch of applied insulation at thicknesses above 3 inches (if foam is applied by being poured into a form, which is the typical application method for polyurethane foam on jacketed UFHWSTs). Manufacturers stated that due to the changing foam density as the insulation thickness increases, the R-value per inch is expected to diminish as insulation thickness is increased, especially as thickness increases beyond 3 inches. As a result, when more than 3 inches of insulation thickness is applied, it is unclear how much additional R-value could be achieved by continuing to increase the thickness of the foam of jacketed UFHWSTs. Unjacketed tanks, which are intended for outdoor installation and may not have the same space constraints as indoor units, do not have an outer metal jacket enclosing and protecting the foam. As a result, unjacketed tanks can be spray-foamed in layers, which reduces the compression of the foam and mitigates the potential for changes in foam density at thicknesses above 3 inches. However, all UFHWSTs were considered in a single equipment class (as discussed in section IV.A.1 of this document), so the max-tech level for jacketed UFHWSTs was applied for all UFHWSTs in this analysis. Furthermore, feedback from manufacturers and DOE's previous knowledge of the UFHWST market indicated that at least 90 percent of UFHWSTs are jacketed and intended for indoor installation.

Therefore, DOE expects uncertainty related to the effective R-value of insulation for insulation thicknesses above 3 inches. Because thicknesses above 3 inches are not

typically used on jacketed UFHWSTs, the improvement in R-value as insulation thickness increases beyond 3 inches for jacketed tanks is unclear at this time. Therefore, due to the high level of uncertainty regarding the R-value of foam insulation with thickness greater than 3 inches, DOE has limited its analysis to considering only up to 1 additional inch of insulation thickness above the baseline insulation level of 2 inches, so 3 inches of foam insulation was considered the max-tech efficiency level for UFHWSTs in this analysis.

DOE requests data and information related to achievable R-values of polyurethane foam insulation on jacketed UFHWSTs at thicknesses above 3 inches. DOE also seeks comment on its understanding of the difficulties associated with applying more than 3 inches of foam to jacketed UFHWSTs.

DOE also included one intermediate level of added insulation in its analysis, with 0.5 inch of added insulation above the 2-inch baseline that results in R-12.5. DOE has assumed for its analysis that polyurethane foam has an R-value per inch of 6.25 (up to a maximum thickness of 3 inches). The selected ELs used in the analyses for this NOPD are shown in Table IV.1.

Table IV.1 Efficiency Levels for Representative UFHWSTs Based on Increased Insulation

Efficiency Levels	Insulation Thickness (Polyurethane Foam)	R-value of Insulation
Baseline – EL0	2 inches	R-12.5
EL1	2.5 inches	R-15.625
EL2	3 inches	R-18.75

DOE seeks comment on the considered efficiency levels analyzed for UFHWSTs. Additionally, DOE seeks comment on its assumption that polyurethane foam has an R-value per inch of 6.25, up to a maximum thickness of 3 inches.

2. Representative Equipment for Analysis

For the engineering analysis, DOE analyzed the publicly-available details, including storage volumes and other critical features, of UFHWST models available on the market and conducted interviews with manufacturers under NDAs to determine appropriate representative equipment to analyze. In response to the August 2019 RFI, several commenters highlighted the customized and variable nature of the UFHWST market. (BWC, No. 5 at pp. 1-2; AHRI, No. 6 at p. 2; A.O. Smith, No. 8 at p. 1) BWC stated that it does not believe it is possible to have one representative volume of UFHWSTs (or more in a reasonable quantity). BWC also commented that it would be difficult to have a representative application with associated R-value, ambient conditions, tank setpoint, and draw patterns for UFHWSTs and suggested that DOE's analysis should not be overly simplified if it is acknowledged that tank orientation can affect heat losses. (BWC, No. 5 at pp. 2-3) A.O. Smith recommended that DOE conduct its analysis using various standard models, but the agency should keep in mind the customized nature of the UFHWST market. (A.O. Smith, No. 8 at p. 1)

To account for the wide range of UFHWSTs on the market, DOE chose several representative baseline units for analysis. As discussed in section IV.C.1.c of this document, DOE also included several ambient temperature conditions in its energy use analysis to reflect typical installation locations (*i.e.*, indoors in mechanical rooms or

outdoors in “Very Hot” and “Hot” regions). Although UFHWSTs can be installed horizontally or vertically, DOE used a conservative assumption in its energy use analysis that water temperature would remain uniformly at 140 °F (as discussed in section IV.C.1.b of this document, DOE did not consider stratification of water temperatures inside the tank and assumed that a tank would always be full of hot water). Therefore, DOE determined that installation orientation would not have a significant impact on its energy use analysis results, so the Department calculated estimated standby losses based on all tanks being vertical, because vertical installations are the most common. The characteristics of these representative units are listed in Table IV.2.

Table IV.2 Representative Tank Characteristics

Volume Range (gal.)	Representative Volume (gal.)	Representative Dimensions	
		Height (in.)	Diameter (in.)
0 to 100	50	47	22
101 to 250	175	65	28
251 to 500	375	72	42
501 to 1000	750	141	42
1001 to 2000	1500	124	60
2001 to 5000	3500	168	84
>5000	5000	180	96

In response to the August 2019 RFI, BWC stated that most manufacturers use polyurethane foam to insulate UFHWSTs, although fiberglass may be used in certain areas or on certain tanks where it is difficult to apply foam. (BWC, No. 5 at p. 2) As discussed in section IV.C.1 of this document, in its energy use analysis, DOE divided the surface area of each tank, at each EL, into several zones and assigned a representative R-value to each zone depending on the expected insulation type and thickness. Although

most tank surfaces can be insulated with 2 inches of polyurethane foam, it is not practical to insulate all surfaces with polyurethane foam due to the insulation application process or the need to retain access to certain ports. In particular, it can be difficult to insulate the areas surrounding fittings, manholes or handholes, and the tops or bottoms of tanks with polyurethane foam, so DOE accounted for the use of other insulating materials in those areas. Similarly, certain fittings and ports will remain uninsulated due to the need to be accessible, situations for which DOE also accounted in its analysis.

In publicly-available equipment literature, DOE observed that the typical number of ports on UFHWSTs ranged from 5 to 11. These ports can include an inlet port, an outlet port, a temperature sensor, a temperature and pressure relief valve, a drain, a recirculation valve, one or more ports for anode rods, and other custom fittings. In its energy use analysis, DOE selected 7 ports as a representative number of ports. DOE further assumed that a 2-inch-wide ring of fiberglass would be placed around each port. DOE also included a small area (1.5 inches in diameter) of uninsulated tank at each port to reflect losses through adjoining pipes or fittings. Wherever fiberglass was modeled as the insulation for tanks, the thickness of fiberglass was the same as the thickness of polyurethane foam on the same tank (which for the analysis in this NOPD, depends on the EL) because the thickness of insulation would be uniformly constrained by the outer metal jacketing on most UFHWSTs. The R-values for each insulation type and at each EL are shown in Table IV.3.

Table IV.3 Insulation R-Values

Material	R-value per inch	Effective R-Value		
		EL0	EL1	EL2
Polyurethane Foam	6.25	12.5	15.625	18.75
Fiberglass	3.5	7	8.75	10.5

Bare Tank (free convective heat transfer to air)	N/A	0.33	0.33	0.33
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Based on feedback from manufacturers and its own review of publicly-available materials, DOE also assumed that the tank tops would be covered with fiberglass instead of polyurethane foam, and that an extra maintenance access port (a 6 inch by 4 inch hand hole for tanks with storage volumes up to 500 gallons, or a 12 inch by 16 inch manhole for tanks with storage volumes greater than 500 gallons) would be partially covered with fiberglass and partially bare.

DOE requests comment on the inputs and assumptions used in its engineering analysis. In particular, DOE requests input on its choice of representative volumes, its assumptions about the typical coverage of various insulation materials, and its estimated R-values for each insulation material at each EL considered.

3. Cost Analysis

The cost analysis portion of the Engineering Analysis is typically conducted using one or a combination of cost approaches. The selection of cost approach depends on a suite of factors, including the availability and reliability of public information, characteristics of the regulated equipment, and the availability and timeliness of

purchasing the equipment on the market. The cost approaches are summarized as follows:

- Physical teardowns: Under this approach, DOE physically dismantles commercially-available equipment, component-by-component, to develop a detailed bill of materials for the equipment.
- Catalog teardowns: In lieu of physically deconstructing equipment, DOE identifies each component using parts diagrams (available from sources such as manufacturer websites or appliance repair websites) to develop the bill of materials for the equipment.
- Price surveys: If a physical or catalog teardown is infeasible (*e.g.*, for tightly integrated equipment such as fluorescent lamps, which are infeasible to disassemble and for which parts diagrams are unavailable), cost-prohibitive, or otherwise impractical (*e.g.* large commercial boilers), DOE conducts price surveys using publicly-available pricing data published on major online retailer websites and/or by soliciting prices through distributors or other commercial channels.

As discussed in section IV.D of this document, DOE did not conduct a cost analysis because DOE did not have the requisite inputs to develop its LCC model with a degree of certainty that would meet the statute's "clear and convincing" evidentiary

threshold. DOE likewise did not expend resources to generate the cost-efficiency curve, as it is unnecessary without an LCC model to feed into.

C. Energy Use Analysis

As discussed, UFHWSTs store hot water and do not directly consume fuel or electricity for the purpose of heating water, so any potential amendments to the standard would reduce standby loss of heat from the stored water. Further, DOE currently only prescribes a minimum insulation requirement (as opposed to a minimum efficiency requirement) for UFHWSTs. Accordingly, the energy use analysis determines the annual energy consumption of paired water heaters and boilers due to standby loss of the UFHWSTs and assesses the energy savings potential of increasing the stringency of the required insulation for UFHWSTs.

1. Tank Thermal Loss Model

For this determination, DOE adapted the thermal loss model described in the technical support document (TSD) for the commercial water heating energy conservation standards (ECS) NOPR published in the *Federal Register* on May 31, 2016 (81 FR 34440; May 2016 CWH ECS NOPR), with some modifications to how the tank surface areas are defined.⁷ These modifications were introduced to capture equipment performance that results from differences in surface insulation thickness over different

⁷ Available at: <https://www.regulations.gov/document?D=EERE-2014-BT-STD-0042-0016>, section 5.5.3 (Last accessed: April 8, 2020).

areas of tank (*i.e.*, insulation around fittings and access ports). These differences are described in section IV.C.1.a of this document.

$$Q_{hr,j} = \sum_{i=1}^6 \frac{A_{i,j} \times [T_i - T_{amb,z}]}{R_{i,j}}$$

Where:

$Q_{hr,j}$ = The hourly heat loss for the UFHWST for each efficiency level (EL) j (Btu/hr).

i = The surface area of the cylindrical tank is divided into different zones each indexed i .

$A_{i,j}$ = The area of each zone i at each EL j (ft²).

T_i = The constant internal water temperature for each tank zone i (°F).

$T_{amb,z}$ = The ambient air temperature for each climate zone z (°F).

$R_{i,j}$ = The net R-value of the insulation for each zone i at each EL j (°F·ft²·hr/Btu).

a. Tank Surface Area ($A_{i,j}$)

As discussed in section IV.B.2 of this document, DOE used a conservative assumption in its energy use analysis that water temperature would remain uniformly at 140 °F and did not consider stratification of water temperatures inside the tank.

Therefore, although tanks can be installed horizontally or vertically, there is no difference in thermal losses between these configurations, and DOE only used vertical tanks in its analysis. The UFHWST's total external surface area was divided into separate zones,

where i is the index for each zone. Zones represent the different areas of an UFHWST that would have unique insulative values. These zones are described in more detail in section IV.B of this document.

$A_{TankTop}$ = When the UFHWST is oriented vertically, this represents the tank's top surface.

$A_{Fittings}$ = Is the sum of all uninsulated areas of the tank's surface devoted to fittings.

$A_{FittingInsulation}$ = Is the sum of all insulated areas of the tank's surface surrounding the (uninsulated) fittings.

$A_{AccessPort}$ = Is the sum of all insulated areas of the tank's surface devoted to the tank's cleanout hand hole port or manhole.

$A_{TankWall}$ = When the UFHWST is oriented vertically, this represents the tank's walls.

$A_{TankBottom}$ = When the UFHWST is oriented vertically, this represents the tank's bottom surface.

b. Tank Internal Water Temperature (T_i)

For this analysis, DOE assumed that the water inside the UFHWSTs is at a constant uniform temperature of 140 °F, which is the average water temperature required by the current Federal test procedures for storage-type CWH equipment during standby loss testing. *See generally* 10 CFR 431.106; 10 CFR part 431, subpart G, appendix A, section 6; 10 CFR part 431, subpart G, Appendix B, section 5. Because UFHWSTs serve the same function as storage-type CWH equipment in standby mode, DOE expects that

similar conditions would be appropriate for UFHWSTs as for storage-type CWH equipment in standby mode. DOE used a conservative assumption that internal water temperatures would remain indefinitely at 140 °F. In reality, the rate of heat loss from a UFHWST would decrease slowly as the temperature difference between the internal stored water and the ambient air decreased. However, because this effect would be minimal, DOE did not consider stratification of water temperatures inside the tank and assumed that a tank would always be full of hot water. Therefore, DOE held the temperature T constant across all tank zones i .

DOE requests comment on the appropriateness of its assumption regarding the use of a constant internal water temperature of 140 °F.

c. Tank Ambient Temperature ($T_{amb, z}$)

Based on feedback from manufacturers during interviews conducted under NDA, DOE assumed that 90 percent of UFHWSTs would be installed indoors and that the remaining 10 percent would be installed outdoors. DOE assumed that all tanks that are installed indoors would have a constant ambient temperature of 75 °F, which is the average air temperature required by the current Federal test procedure for storage-type CWH equipment during standby loss testing. *See generally* 10 CFR 431.106; 10 CFR part 431, subpart G, appendix A, section 6; 10 CFR part 431, subpart G, Appendix B, section 5.

For the fraction of UFHWSTs that are installed in outdoor, or non-conditioned, spaces, DOE defined each climate zone (z) and calculated the monthly average

temperatures from Typical Meteorological Year 3 (TMY3)⁸ data for the Building America climate regions 1A, 2A, and 2B.^{9, 10} The temperatures for each region are represented by the cities in Table IV.4. The monthly regional averages were then weighted using the regional city populations based on data from 2018 Census.¹¹

Table IV.4 Climate Zones and Representative Cities

Climate Zone	Population	Representative City	TMY Location #
1A	6,208,359	Miami	722020
2A	38,418,718	Houston	722430
2B	6,869,283	Phoenix	722780
3A	43,230,951	Atlanta	722190
3B – CA	29,951,605	Los Angeles	722950
3B – Non CA	5,546,151	Las Vegas	723677
3C	8,596,694	San Francisco	724940
4A	69,154,015	Baltimore	724060
4B	2,245,023	Albuquerque	723650
4C	9,696,610	Seattle	727930
5A	70,727,419	Chicago	725300
5B	13,119,013	Boulder	724699
6A	17,705,715	Minneapolis	726580
6B	2,650,907	Helena	727720
7	2,625,239	Duluth	727450
8	170,286	Fairbanks	702610

⁸ The TMY data sets hold hourly values of solar radiation and meteorological elements for a 1-year period. Their intended use is for computer simulations of solar energy conversion systems and building systems to facilitate performance comparisons of different system types, configurations, and locations in the United States and its territories. Because they represent typical rather than extreme conditions, they are not suited for designing systems to meet the worst-case conditions occurring at a location.

⁹ Wilcox, S. and W. Marion, 2008 User's Manual for TMY3 Data Sets, NREL/TP-581-43156 (April 2008) (Available at: <https://www.nrel.gov/docs/fy08osti/43156.pdf>).

¹⁰ Building America Best Practices Series, Volume 7.3, Guide to determining climate regions by county 2015 (Available at: https://www.energy.gov/sites/prod/files/2015/10/f27/ba_climate_region_guide_7.3.pdf).

¹¹ U.S. Census Population Estimates by County, as of 2018 (Available at: https://www.census.gov/data/tables/time-series/demo/popest/2010s-counties-total.html#par_textimage).

While a UFHWST can be installed outdoors anywhere in the Nation, for this analysis, DOE is using the assumption that these installations will only occur in the “Very Hot” and “Hot” regions (Building America climate zones 1A, 2A, and 2B) where the chance of overnight freezing is very low.

Table IV.5 shows the fraction of UFHWSTs installed indoors versus outdoors, and the monthly average ambient temperature values for each $T_{amb, z}$.

Table IV.5 Average Monthly Ambient Temperatures

Climate Zone/Location (z)	Location Weight	Average Temperature for Month (°F)											
		1	2	3	4	5	6	7	8	9	10	11	12
1A	0.012	67	70	71	75	80	82	83	82	81	79	74	69
2B	0.075	55	60	63	75	81	93	96	93	87	77	64	53
2A	0.013	51	55	61	69	75	81	83	83	80	69	63	55
Indoor	0.900	75	75	75	75	75	75	75	75	75	75	75	75

DOE requests comment on its assumption regarding the typical ambient temperatures for UFHWSTs installed indoors and outdoors.

DOE requests comment on its assumption that 10 percent of all UFHWST would be installed outdoors. DOE requests information on the typical capacities and R-values of outdoor equipment.

DOE requests comment on its assumption that outdoor installations would be limited to climate zones 1A, 2A, and 2B. DOE requests information or data on the fraction of installations that occur within these, or other, climate zones.

d. R-value of Insulation ($R_{i,j}$)

The R-value of each zone i of the UFHWST is defined for each EL j in the engineering analysis in Table IV.1 and Table IV.3 of section IV.B of this document.

DOE requests comment on its Tank Thermal Loss Model.

2. Annual Energy Use Due to UFHWST Losses

To calculate the energy used by the boiler attributable to the heat losses of the UFHWSTs, DOE used the following equation for each EL listed in Table IV.1 of this document:

$$EBoil_j = Q_{hr,j} \times 8760 \times \frac{1}{Boiler_{\eta,yr}}$$

Where:

$EBoil_j$ = The energy by the boiler required to maintain the water temperature in the UFHWST at the temperature T_i at each EL j , (Btu/yr),

$Q_{hr,j}$ = hourly heat loss for the UFHWST at each EL j (see section IV.C.1, (Btu/hr) of this document), and

$Boiler_{\eta}$ = average boiler efficiency (%) in year yr (defined in section IV.F.2 of this document).

Table IV.6 presents the energy used by the boiler attributable to the heat losses of the UFHWST at the baseline (EL 0) and each EL by tank capacity. Table IV.7 presents the resulting energy savings at each EL above baseline. The representative storage volumes used in this analysis are discussed in section IV.B.2 of this document.

Table IV.6 Boiler Energy Use Due to UFHWST Heat Losses in 2025 (MMBtu/yr)¹²

EL	Capacity (US gal)						
	50	175	375	750	1500	3500	5000
0	1.76	2.78	4.71	8.59	11.44	21.09	25.27
1	1.55	2.39	3.97	7.32	9.63	17.45	20.80
2	1.41	2.13	3.48	6.48	8.42	15.02	17.83

Table IV.7 Savings in Boiler Energy Use Due to Reduced UFHWST Heat Losses in 2025 (MMBtu/yr)

EL	Capacity (US gal)						
	50	175	375	750	1500	3500	5000
1	0.21	0.39	0.74	1.26	1.81	3.64	4.47
2	0.35	0.64	1.23	2.10	3.02	6.07	7.44

3. Additional Sources of Uncertainty

As discussed in section IV.B.2 of this document, the inputs to DOE's tank thermal loss model were primarily based on publicly-available information, DOE's previous knowledge of UFHWSTs, and feedback from manufacturers received during interviews conducted under NDAs. To validate the model, DOE compared the results produced by

¹² The projected value for Boiler Efficiency (*Boiler_n*) is 0.922 in 2027, see section IV.F.2 of this document for more details.

the model to results of testing previously conducted to evaluate the performance-based test procedure proposed for UFHWSTs in the May 2016 CWH TP NOPR, which was largely based on the standby loss test procedure for commercial storage water heaters. The proposed test procedure included a standby loss test that would be conducted as the mean tank water temperatures decay from 142 °F to 138 °F at a nominal ambient temperature of 75 °F. 81 FR 28588, 28603 (May 9, 2016). Standby loss tests were conducted on 17 UFHWSTs with an advertised insulation level of R-12.5 and storage volumes of 40, 80, or 120 gallons in order to gather data on whether measured standby losses were consistent with what would be expected from tanks insulated to their rated and/or advertised insulation levels, to assess the repeatability and sensitivity of the proposed test procedure, and to gather data on the potential burden in conducting the testing.

DOE used the same analytical model described in this section to calculate the expected losses from each of these tanks, using their measured dimensions and actual number of ports. As discussed, the internal water temperature (140 °F) and ambient air temperature (75 °F) used for the analytical model were the same as the average temperatures seen during the physical testing. The same assumptions about insulation details (*e.g.*, R-values for different materials and the use of fiberglass around ports) were used as were used for the baseline (R-12.5) units in DOE's thermal loss model. The average predicted rate of standby losses for these tanks were 73 percent of the measured standby losses and ranged from as low as 58 percent of the measured losses up to 90 percent of the measured losses. Because the estimated standby losses are significantly lower than the measured losses, this suggests that DOE's thermal loss model undercounts

the actual standby losses that would occur in the field. Furthermore, the wide range in calculated standby losses as compared to measured standby losses indicates that the accuracy of the thermal loss calculations in predicting the standby losses of a particular model will be somewhat unpredictable, thereby adding additional uncertainty.

Furthermore, when DOE conducted standby loss tests of UFHWSTs, it found that tanks with identical storage volumes, dimensions, number of ports, and nominal insulation levels differed by up to 8.5 percent, whereas DOE's model would predict the same level of standby losses for these tanks. This finding suggests that there may be variations in the extent of R-12.5 coverage between units, even between units from the same manufacturer. As discussed in section IV.B.2 of this document, it may not be practical to insulate all surfaces of UFHWSTs with polyurethane foam due to the nature of the insulation application process or the need to retain access to certain ports. Differences in manufacturers' tank designs, manufacturing processes, or their interpretations of the R-12.5 insulation requirement could lead to variations in the amount of tank surface area that is actually insulated with R-12.5. Therefore, tanks that appear to have the same attributes and insulation may have different levels of standby losses in the field. This source of potential variation in standby losses further supports DOE's conclusion that there may be additional sources of thermal losses that vary between tanks and that are not adequately captured in its current thermal loss model. This variation also makes it very difficult for DOE to characterize the representative performance of a "baseline" UFHWST, or the expected performance at any potential amended standard level, with a high degree of confidence since there is significant variation in thermal energy losses at a given efficiency level (R-value) that cannot be readily predicted or

otherwise accounted for in the analysis. Due to these potential variations in insulation coverage and because DOE has not been able to verify its thermal loss model against its physical test results, there is significant uncertainty as to the validity of its energy use analysis.

D. Life-Cycle Cost and Payback Period Analysis

To determine whether a standard is economically justified, EPCA requires DOE to consider the economic impact of the standard on manufacturers and consumers, as well as the savings in operating costs throughout the estimated average life of the equipment compared to any increase in price, initial charges, or maintenance expenses of the equipment likely to result from the standard. (42 U.S.C. 6313(a)(6)(B)(i)-(ii)) The effect of new or amended energy conservation standards on individual consumers usually involves a reduction in operating cost and an increase in purchase cost. To evaluate the economic impacts of potential energy conservation standards on individual consumers, in order to determine whether amended standards would be economically justified, DOE typically uses the following two metrics:

- The LCC is the total consumer expense of equipment over the life of that equipment, consisting of total installed cost (manufacturer selling price, distribution chain mark-ups, sales tax, and installation costs) plus operating costs (expenses for energy use, maintenance, and repair). To compute the operating costs, DOE discounts future operating costs to the time of purchase and sums them over the lifetime of the equipment.

- The PBP is the estimated amount of time (in years) it takes consumers to recover the increased purchase cost (including installation) of more-efficient equipment through lower operating costs. DOE calculates the PBP by dividing the change in purchase cost at higher efficiency levels by the change in annual operating cost for the year that amended or new standards are assumed to take effect.

For any given efficiency level, DOE typically measures the change in LCC relative to the LCC in the no-new-standards case, which reflects the estimated efficiency distribution of equipment in the absence of new or amended energy conservation standards. In contrast, the PBP for a given efficiency level is measured relative to the baseline equipment.

1. Installation Costs

Installation cost includes labor, overhead, and any miscellaneous materials and parts needed to install the equipment. In response to the August 2019 RFI, DOE received several comments related to installation issues associated with UFHWSTs with increased insulation thickness. BWC and AHRI stated that increasing the size of UFHWSTs by increasing the thickness of required insulation will lead to difficulties getting tanks through doorways and to their final locations in existing mechanical rooms. (BWC, No. 5 at p. 2 and AHRI, No. 6 at p. 2)

AHRI commented that reducing the storage volume of the tank itself is not a practical option because the most critical design feature of UFHWSTs is their storage

volume. (AHRI, No. 6 at pp. 1-2) AHRI asserted that the predominant market for UFHWSTs are replacement installations, and again increased insulation would lead to difficulties with replacement because of space constraints in existing mechanical rooms. Additionally, BWC suggested that this could potentially necessitate the following changes: replacement of one UFHWST with two UFHWSTs, addition of mechanical rooms, or changes to system configurations. (BWC, No. 5 at p. 2)

Feedback from manufacturer interviews conducted under NDAs also suggests that manufacturers are very concerned that increases in overall UFHWST dimensions due to increased insulation thickness could require modifications to existing doorways or mechanical rooms, in order to be able to replace existing tanks with a single tank of similar volume, which would significantly increase installation costs.

In response to these comments from BWC and AHRI, DOE examined some of the potential installation costs (*i.e.*, widening doorways that lead to the mechanical room and expanding the mechanical room itself). To estimate the costs of expanding doorways in order to allow UFHWSTs to pass through, DOE was able to examine the cost of door removal and reinstallation using data for exterior and interior door installations available in the RSMeans 2020 Estimating Handbook Online.¹³ DOE examined the cost breakdown of installing new fire-rated doorways, both at 3 to 4-foot, and 6 to 7-foot width ranges, as well as interior passage doors at these same widths. For these doorway

¹³ *RSMeans Data from Gordian* (2020) (Available at: <https://www.rsmeansonline.com/>) (Last Accessed: July 20, 2020). For details, please see the following records: B20301251800 : Door, single, exterior fire door, "A" label, B20301252500: Door, double, exterior fire door, "A" label, C10201101600: Door, interior fire door, B20301251900: Door, double, aluminum, entrance, B20301251200: Door, single, aluminum, entrance.

types, DOE did not use the entire installation values cited in the literature; rather, DOE only used the portions of the cost associated with the installation of existing frames and doors. DOE expects that comparable costs would be required to remove existing doors in a manner where they could be reinstalled without the need for new equipment, so for this estimate, the doorway installation cost were doubled to reflect both removal and reinstallation. Under this scenario, DOE found that door removal and reinstallation costs could potentially increase the cost of UFHWST installation by between \$280 and \$1720 for every doorway requiring modification. DOE currently has no method of determining the average number of doorways that a UFHWST would need to pass through during the course of installation which increases the potential range of installation costs.

For this NOPD, DOE was unable to find detailed data characterizing the costs of restructuring the mechanical room. However, DOE was able to examine other water-heating rulemakings with equipment with water storage characteristics where replacement installations could prove difficult. Specifically, DOE compared the magnitude of difference between the average, the 95th percentile, and maximum installation costs for the following *baseline* equipment as a proxy for potential customer impacts in extreme cases. DOE also does not currently have enough data indicating the percentage of UFHWST installations that could necessitate building modifications to get the UFHWST to its destination in the mechanical room, if tank dimensions were increased. However, the results in Table IV.8, while illustrative, are not exhaustive, and they show that the potential range of increased costs is significant, particularly for commercial equipment where the range of potential installation costs can be greater than 50 percent than the average in some extreme cases. It is expected that these costs would

often be unavoidable because building owners are likely unable to substitute these tanks with tanks of alternative dimensions or volumes to meet operational needs and fit in existing spaces.

Table IV.8 Magnitude of Potential Increase in Installation Costs

Equipment	Installation Cost (\$)			Increase over Mean (%)	
	Mean	95 th -Percentile	Maximum	95 th -Percentile	Maximum
Commercial-Duty Gas Storage Water Heater ¹⁴	812	1,225	2,432	51%	199%
Residential-Duty Commercial Gas Storage Water Heater ¹⁵	678	1,001	2,088	48%	208%
Commercial Electric Storage Water Heater ¹⁶	1,054	1,325	1,773	26%	68%
Consumer Gas-fired Storage Water ¹⁷	630	1,375	2,370	118%	276%
Consumer Electric Storage Water Heaters ¹⁸	288	402	498	40%	73%
Consumer Oil-fired Storage Water Heaters ¹⁹	1,974	2,283	2,910	16%	47%

¹⁴ U.S. Department of Energy, Energy Efficiency and Renewable Energy Office, Energy Conservation Standards for Commercial Water Heating Equipment, NOPR Analytical Spreadsheet: Commercial Water Heater (CWH) Life Cycle Cost (LCC) and Payback Period Analysis (April 20, 2016) (Available at: <https://regulations.gov/document/EERE-2014-BT-STD-0042-0013>). See worksheet labelled: Forecast Cells.

¹⁵ *Ibid.*

¹⁶ *Ibid.*

¹⁷ U.S. Department of Energy, Energy Efficiency and Renewable Energy Office, Energy Efficiency Standards for Pool Heaters, Direct Heating Equipment and Water Heaters, 2010-04-06 Final Rule Analytical Tools (July 1, 2011) (Available at: <https://www.regulations.gov/document?D=EERE-2006-STD-0129-0148>). See: 2010-03-26 Life Cycle Cost Electric Storage Water Heaters.xlsx.

¹⁸ U.S. Department of Energy, Energy Efficiency and Renewable Energy Office, Energy Efficiency Standards for Pool Heaters, Direct Heating Equipment and Water Heaters, 2010-04-06 Final Rule Analytical Tools (July 1, 2011) (Available at: <https://www.regulations.gov/document?D=EERE-2006-STD-0129-0148>). See: 2010-03-26 Life Cycle Cost Gas-fired Storage Water Heaters.xlsx.

¹⁹ U.S. Department of Energy, Energy Efficiency and Renewable Energy Office, Energy Efficiency Standards for Pool Heaters, Direct Heating Equipment and Water Heaters, 2010-04-06 Final Rule Analytical Tools (July 1, 2011) (Available at: <https://www.regulations.gov/document?D=EERE-2006-STD-0129-0148>). See: 2010-03-24 Life Cycle Cost Oil-fired Storage Water Heaters.xlsx.

DOE recognizes that increasing installation costs can reduce, or even eliminate, the future economic consumer benefits from a potential new standard. Because of this, DOE tentatively agrees with the commenters that installation costs for certain UFHWST customers could include the removal and reinstallation of exterior and interior doorways, and in some extreme cases, it could require the restructuring of existing mechanical rooms to fit the new replacement equipment if the dimensions of UFHWSTs are increased. Furthermore, DOE tentatively agrees with the commenters that a small increase in tank dimensions in a potential new standards case could potentially disproportionately increase the installation costs for a fraction of consumers of replacement equipment. While the fraction of impacted consumers is uncertain, DOE is certain that there will be some consumers who will experience these higher installation costs. These higher installation costs for replacement equipment create uncertainty regarding the positive economic benefits for a potentially significant fraction of consumers from an amended standard for UFHWSTs.

DOE requests data and information which can be used to estimate installation costs of UFHWSTs with modified dimensions.

DOE requests information and data characterizing the types of buildings where installation difficulties are likely to occur and to lead to increased installation cost, as well as the frequency with which such installation problems may arise.

DOE requests information and data characterizing the average installation costs for UFHWSTs at all different storage volumes.

DOE requests information and data characterizing the circumstances that would drive the decision to potentially restructure an existing building spaces, including doorways and mechanical rooms, when installing a replacement UFHWST. For example, is the decision driven by a minimum building code requirement for door openings?

2. Annual Energy Consumption

DOE typically determines the annual energy consumption for equipment at different efficiency levels. DOE's approach to determining the annual energy consumption of UFHWSTs is described in section IV.C of this document. In response to the August 2019 RFI, A.O. Smith suggested that any potential energy savings resulting from changes to insulation thickness would be small and significantly outweighed by the costs that would be borne by commercial customers and manufacturers. (A.O. Smith, No. 8 at p. 2)

As discussed in section V.A.1 of this document, DOE estimates that amended standards at the max-tech level would result in site energy savings (*i.e.*, realized at the source of hot water by either a water heater or hot water supply boiler) of 0.017 quads over 30 years. However, as discussed in section IV.C.1 of this document, even small adjustments to several critical inputs to the model could have a large impact on these results and could significantly alter the findings. For example, as explained previously, the inputs to the tank thermal loss model are primarily based on publicly-available data and information gathered during manufacturer interviews, but as discussed earlier, the results from this model underestimate losses as compared to those observed during

testing of UFHWSTs that was previously done to evaluate the test procedure proposed for UFHWSTs in the May 2016 CWH TP NOPR. These uncertainties would propagate through the cost-benefit analyses and could potentially significantly reduce the energy savings from amended standards. Therefore, DOE did not conduct an LCC and PBP analysis for this NOPD.

E. Shipments Analysis

DOE uses projections of annual equipment shipments to calculate the national impacts of potential amended or new energy conservation standards. The shipments model takes an accounting approach in tracking market shares of each equipment class and the vintage of units in the stock. Stock accounting uses equipment shipments as inputs to estimate the age distribution of in-service equipment stocks for all years.

In response to the August 2019 RFI, AHRI stated that it would provide DOE with 2018 shipments data for UFHWST. (AHRI, No. 6 at p.1) However, no data were received, so DOE developed its own shipments estimates based on available data.

To project shipments and equipment stocks for 2025 through the end of the 30-year analysis period (2054), DOE used a stock accounting model. Future shipments are calculated based on projections in *Annual Energy Outlook 2021 (AEO 2021)* (see section IV.E.3 of this document for further details). The stock accounting model keeps track of shipments and calculates replacement shipments based on the expected service lifetime of UFHWSTs and a Weibull distribution that identifies a percentage of units still in existence from a prior year that will fail and need to be replaced in the current year.

AHRI and A.O. Smith both stated that the UFHWST market is very small and often customized, and that the predominant market for UFHWSTs is for replacement equipment. (AHRI, No. 6 at p. 2; A.O. Smith, No. 8 at pp.1) While this may be the case, DOE expects that manufacturers of this equipment will continue to seek out new markets and that some equipment will be sold into new construction. Therefore, the Department developed projections for this market as described in section IV.E.3 of this document.

DOE's approach begins with an estimate of the current stock of UFHWSTs. DOE uses an estimate of average UFHWST lifetime to derive the fraction of the stock that is replaced in each year. DOE then adds an estimate of new UFHWSTs installed in each year.

1. Stock Estimates

DOE investigated each sector that is presumed to operate UFHWSTs: residential, commercial, and industrial. However, DOE was unable to find clear indicators of how many UFHWST are used by any of these sectors, so it developed sectoral stock estimates from publicly-available data, as discussed in the paragraphs that follow.

a. Residential Stock

To estimate the stock of UFHWSTs in the residential sector, DOE examined the Residential Energy Consumption Survey (RECS)²⁰ database. Although RECS does not contain specific fields that indicate the presence of a UFHWST, nor does RECS catalog

²⁰ Presently the 2015 edition of RECs is the most recent version. Energy Information Administration (EIA), 2015 Residential Energy Consumption Survey (RECS) (Available at: <https://www.eia.gov/consumption/residential/>) (Last accessed April 4, 2019).

specific water heating technologies, DOE was able to examine the available sample for buildings that would be likely to contain a UFHWST. DOE assumed that such a building would be characterized as follows:

- A building with multiple residences (TYPEHUQ = 4 and 5),
- where the hot water heater and storage tank are not in the apartment itself (H2OHEATAPT = 2), and
- where the hot water heater is of a type that is tankless, or on-demand. (WHEATSZ = 4)

The results of a search of the RECS database using these assumptions yielded a sample of zero buildings. Based upon these results, DOE tentatively agrees with AHRI's statement that UFHWST are primarily installed in industrial/commercial applications (AHRI, No. 6 at p. 2). Accordingly, DOE has tentatively concluded that the quantity of UFHWST installed in the residential sector is minimal and should not be considered for the purpose of this determination.

b. Commercial Stock

To estimate the stock of UFHWSTs in the commercial sector, DOE examined the Commercial Building Energy Consumption Survey (CBECS).²¹ Although CBECS does

²¹ Presently, the 2012 edition of CBECS is the most recent version. Energy Information Administration (EIA), 2012 Commercial Building Energy Consumption Survey (CBECS) (Available at: <https://www.eia.gov/consumption/commercial/>) (Last accessed April 4, 2019).

not contain specific fields that indicate the presence of a UFHWST, DOE was able to examine the available sample for buildings that would be likely to contain a UFHWST. DOE assumed that such a building would be characterized as follows:

- A building with water heating equipment (WTHTEQ = 1), and
- Where the main heating equipment is boilers inside (or adjacent to) the building that produce steam or hot water (MAINHT = 3).

The results of a search of the CBECS database using these assumptions yielded a commercial sample of 325,089 buildings in 2012. DOE could not find any data specifying the quantity of UFHWSTs per commercial building, so for this analysis, DOE assumed one UFHWST per building of all sizes. From this sample DOE also found that 99.2 percent of these buildings use natural gas as their primary energy source for water heating, with the remaining 0.8 percent of buildings using district water heating,²² electricity, heating oil, or other fuels. For purpose of this analysis, DOE considered 100 percent of commercial buildings to use natural gas to heat water.

c. Industrial Stock

DOE examined the industrial data source listed in the August 2019 ECS RFI and was not able to determine an appropriate stock sample from the highly aggregated data

²² “District heating” is an underground infrastructure asset where thermal energy is provided to multiple buildings from a central energy plant or plants. In this context, it would be operated by local governments.

available.^{23,24} DOE understands that UFHWSTs are used to store potable hot water for human consumption and washing, not for industrial process water. Therefore, DOE assumed that the need for hot water storage would be the similar across both commercial and manufacturing sectors on a per-person basis.

To estimate the stock of industrial consumers, DOE used the number of manufacturing employees from the 2017 census.²⁵ DOE first determined the ratio of UFHWSTs per commercial employee. DOE then used the ratio of the employee count from the commercial sample described in section IV.E.1.b of this document over the total number of commercial employees to represent the number of UFHWSTs in the commercial sector on a per-employee basis. DOE then applied this ratio to the total number of manufacturing employees from the 2017 census to produce a National stock estimate for the industrial sector.

Table IV.2 presents the estimated stock of UFHWSTs in each sector, in 2012.

Table IV.9 Estimated UFHWST Stock (2012)

Sector	Number of Units	Weight (%)
Residential	0	0
Commercial	315,360	82
Industrial	71,361	18

²³ Energy Information Administration (EIA), 2014 Manufacturing Energy Consumption Survey (MECS) (Available at: <https://www.eia.gov/consumption/manufacturing/data/2014/>) (Last accessed April 4, 2019).

²⁴ Northwest Energy Efficiency Alliance, 2014 Industrial Facilities Site Assessment: Report & Analytic Results, 2014 (Available at: <https://neea.org/img/documents/2014-industrial-facilities-stock-assessment-final-report.pdf>) (Last accessed May 3, 2021).

²⁵ U.S. Census Bureau, All Sectors: Summary Statistics for the U.S., States, and Selected Geographies: 2017, Table EC1700BASIC, 2017 (Available at: <https://data.census.gov/cedsci/table?q=31-33%3A%20Manufacturing&hidePreview=false&tid=ECNBASIC2017.EC1700BASIC&vintage=2017>) (Last accessed: March 27, 2020).

DOE requests comments generally regarding its stock analysis for UFHWSTs.

DOE requests comment regarding its assumption that there would be only one UFHWST per building.

DOE requests comment regarding its disaggregation of UFHWST stock by sector.

DOE requests comment on its assumption that UFHWSTs are not used for industrial process hot water storage.

2. Shipments for Replacement

For this analysis DOE was unable to locate data on average lifetimes for UFHWSTs, and the Department likewise could not find primary data indicating average or maximum lifetimes for UFHSWTs. DOE understands that some of the causes of failure in other hot water storage tanks include corrosion, sediment build-up, and mechanical failures. UFHWSTs are relatively simple equipment when compared to storage-type water heaters that include heating elements or a fossil-fuel burner with a storage tank. The simplicity of UFHWSTs would limit the likelihood of mechanical failure as compared to a storage-type water heater, but they can still fail due to corrosive or sediment build-up. Electric storage water heaters that use electric resistance elements for heating are likewise relatively simple equipment, whereas gas-fired storage water

heaters can be more complex, because they typically require an ignition system, burner, combustion fans (in some cases), associated combustion controls, and flue gas venting system. The mechanical simplicity of electric storage water heaters lends itself to a failure mode related to the storage tank component of the water heating package, which would be expected to be analogous to the typical failure mode for an UFHWST. For this analysis, DOE used the average lifetime for commercial electric storage water heaters (*i.e.*, 12 years) as a proxy for UFHWST lifetime. In the TSD for DOE's May 2016 CWH ECS NOPR (81 FR 34440), the average lifetime for commercial electric hot water storage tanks was estimated to be 12 years. Based on this average lifetime, DOE assumed an 8 percent per year replacement rate for UFHWSTs.

DOE requests comment on its assumption of a 12-year lifetime for UFHWSTs similar to commercial electric hot water storage tanks.

3. Shipments for New Construction

To project shipments of UFHWSTs for new construction, DOE relied on the trends available from the *AEO 2021*. DOE used the Commercial Floorspace and Macro Indicators Employment Manufacturing trends to project new construction for the commercial and industrial sectors, respectively.^{26,27} DOE estimated a saturation rate for

²⁶ U.S. Energy Information Administration, *Annual Energy Outlook (2021)*, Table 22, Commercial Sector Energy Consumption, Floorspace, Equipment Efficiency, and Distributed Generation (Available at: <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=32-AEO2021&cases=ref2021&sourcekey=0>).

²⁷ U.S. Energy Information Administration, *Annual Energy Outlook (2021)*, Table 23, Industrial Sector Macroeconomic Indicators (Available at: <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=34-AEO2021&cases=ref2021&sourcekey=0>).

each equipment type using building and equipment stock values. The saturation rate was applied in each year, yielding shipments to new buildings.

DOE requests comment on its use of *AEO 2021* trends as a scaler to project shipments to new construction.

4. Estimated Shipments

Table IV.10 presents the estimated UFHWST shipments in selected years.

Table IV.10 Shipments Results for UFHWSTs (units)

Year	Shipments
2025	18,292
2030	19,240
2040	21,244
2050	23,208
2060	0

a. Distribution of Shipments by UFHWST Storage Volume

Table IV.11 presents the estimated distribution of UFHWST shipments by the storage volume ranges specified in section IV.B.2 of this document. DOE estimated these values through examination of capacity counts in existing trade literature and DOE's CCMS database. DOE assumes that this distribution is static and does not change over time.

Table IV.11 Distribution of Shipments by UFHWST Storage Volume (gal)

Capacity Range	0 to 100	101 to 250	251 to 500	501 to 1000	1001 to 2000	2001 to 5000	> 5000
Market Share	3%	11%	23%	26%	20%	16%	1%

DOE requests comment on its distribution of shipments by storage volume, and on its assumption that the distribution of shipments by storage volume does not change over time.

5. Additional Sources of Uncertainty

DOE recognizes that the market for UFHWSTs is a relatively highly customized and low-volume shipments market. DOE's review of publicly-available information indicates that annual shipments through 2030 will be below 20,000 units (see the previous section for additional details). Additionally, in response to the August 2019 RFI, BWC submitted a list of over 200 companies which it identified as UFHWST manufacturers, which underscores the low-volume nature of the UFHWST industry. (BWC, No. 5 at p.2) DOE reviewed these companies and found many to be custom fabrication/welding shops or producers of vessels for niche industry processes such as chemical mixing or fuel storage. Although most of the manufacturers listed by BWC may theoretically be capable of manufacturing UFHWSTs, DOE did not find evidence that these businesses advertise or market UFHWSTs. However, DOE was able to confirm that some of the companies listed by BWC manufacture UFHWSTs, and DOE

included these manufacturers in its list of UFHWST manufacturers. In total, DOE has identified 48 UFHWST manufacturers, 37 of which are small domestic manufacturers.

Due to the niche nature of this marketplace, it is difficult to accurately predict how the market would respond to amended standards (*e.g.* whether any manufacturers would face disproportionately high conversion costs, what changes may result to the distribution of tank sizes sold, if consumers would select different equipment to meet their water heating needs, or whether manufacturers might consolidate or exit the market). These uncertainties may substantially impact the findings if DOE were to complete a full economic impact analysis of amended standards for UFHWSTs or estimate the cost-effectiveness of a more-stringent standard.

F. National Impact Analysis

DOE conducted an NIA that assesses the NES in terms of total site energy savings that would be expected to result from new or amended standards at specific efficiency levels. DOE did not assess the net present value (NPV) of the total costs and benefits experienced by consumers as part of the NIA because of the lack of an LCC analysis as previously discussed. DOE calculates the NES for the potential standard levels considered based on projections of annual equipment shipments, along with the annual energy consumption from the energy use analysis. For the present analysis, DOE projected the site energy savings over the lifetime of UFHWSTs sold from 2025 through 2054.

DOE evaluates the effects of amended standards at the national level by comparing a case without such standards (referred to as the no-new-standards case) with standards-case projections that characterize the market for each UFHWST class if DOE were to adopt amended standards at the specified energy efficiency levels for that class. As discussed in the subsections that follow, this analysis requires an examination of both the efficiency of the UFHWST, as well as the efficiency of the appliance supplying heated water to that tank.

1. Energy Efficiency Distribution in the No-New-Standards Case

DOE received limited information regarding the efficiency range of UFHWSTs distributed in commerce in response to its request for comment in the August 2019 ECS RFI. BWC stated that it is appropriate to assume that for this analysis, all UFHWST have R-12.5 insulation (*i.e.*, that they meet the minimum R-value of 12.5 currently required by ASHRAE 90.1). (BWC, No. 5 at p. 3)

To estimate the fraction of equipment sold at or above the current standard, DOE examined the counts and R-values of the records in its Compliance Certification Management System (CCMS) database.²⁸ DOE found that there were a minimal number of designs that related to the R-value efficiency levels determined in the engineering analysis, as demonstrated by Table IV.11. However, DOE notes that the data from the CCMS database is a count of *models* at a given efficiency and not a direct reflection of the number of units shipped at that efficiency level. When weighted as a function of

²⁸ See: <https://www.regulations.doe.gov/ccms>.

shipments, the data shows that the vast majority of shipment are at baseline, as shown in Table IV.13. Consequently, DOE tentatively agrees with the statement from BWC and for this analysis assumed that almost all UFHWST across all capacities are at the baseline efficiency level, R-12.5.

Table IV.12 Fractions of Model Efficiency in CCMS (% of records)

Representative Tank Volume (gal.)	EL 0 (baseline)	EL 1	EL 2
	R-12.5	R-15.62	R-18.75
50	14	2	0
175	21	1	0
375	20	0	0
750	18	0	0
1500	21	0	0
3500	2	0	0
5000	0	0	0

Table IV.13 Fraction of Model Efficiencies as a Function of Shipments (% of records)

Representative Tank Volume (gal.)	Weight	EL 0 (baseline)	EL 1	EL 2
		R-12.5	R-15.62	R-18.75
50	0.03	3	0	0
175	0.11	10	1	0
375	0.23	23	0	0
750	0.26	26	0	0
1500	0.20	20	0	0
3500	0.16	16	0	0
5000	0.01	1	0	0

DOE requests comment regarding its applied efficiency distribution that 99 percent of all units sold are currently at baseline (R-12.5).

2. Hot Water Supply Boiler Efficiency Trend

As stated previously, a potential standard increasing the insulation rating of UFHWST equipment would reduce thermal losses, which would in turn reduce the energy used by a building's hot water supply equipment to provide hot water.²⁹

Determining the impact of reduced UFHWST losses on the connected boiler(s) requires an estimate of the boiler efficiency. To estimate the efficiency of boiler systems, DOE used the No-New-Standards Case (EL0) efficiency distribution data from the May 2016 CWH ECS NOPR³⁰ to calculate a single, market-weighted, average efficiency, which is 84.4 percent in 2016. For years beyond 2016 and future years through 2050, DOE used the *AEO 2021* data series "Commercial: Stock Average Efficiency: Water Heating: Natural Gas: Reference case" to project the efficiency trend of hot-water supply boilers.³¹ DOE assumed no increase in boiler efficiency after 2050 (*i.e.*, the end date for the *AEO 2021* analysis). This efficiency trend is shown in Table IV.14.

Table IV.14 Average Stock Efficiencies of Hot-Water Supply Boilers from 2025-2050

Year	Efficiency (%)
2025	91.5
2030	93.1
2035	94.2
2040	94.8
2045	95.1

²⁹ While there is a wide range of equipment that building owners can use to produce hot water, for this analysis, DOE assumed that 100 percent of all hot water is produced by a hot water supply boiler. See section IV.E.1.b of this document for details.

³⁰ Available at: <https://www.regulations.gov/document?D=EERE-2014-BT-STD-0042-0016> (Last accessed: April 8, 2020).

³¹ U.S. Energy Information Administration, *Annual Energy Outlook (2021)*, Table 22, Commercial Sector Energy Consumption, Floorspace, Equipment Efficiency, and Distributed Generation (Available at: <https://www.eia.gov/outlooks/aeo/data/browser/#/?id=32-AEO2021&cases=ref2021&sourcekey=0>) (Last accessed April 23, 2021).

2050	95.3
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G. Discussion of Other Comments Received

In response to the August 2019 RFI, DOE received several comments in support of the current efficiency standard. BWC stated that the current efficiency requirement (a minimum insulation value of R-12.5) is an appropriate baseline efficiency level. (BWC, No. 5 at p. 2) Similarly, AHRI recommended that DOE maintain the current minimum insulation requirement of R-12.5. (AHRI, No. 6 at p. 2) BWC and A.O. Smith also said that there have not been significant market changes since their last energy conservation standard change and that a revised standard would not result in significant energy savings. (BWC, No. 5 at p. 2; and A.O. Smith, No. 8 at p. 2)

Additionally, BWC submitted comments related to the proposed manufacturer mark-up and the distribution channels used to characterize the UFHWST market in the August 2019 RFI. (BWC, No. 5 at p. 2) A.O. Smith commented that the majority of UFHWSTs are sold as replacement units and stated that major redesigns of existing product lines are very uncommon and potentially cost-prohibitive. (A.O. Smith, No. 8 at p. 2)

As discussed previously, certain economic analyses were not conducted for this NOPD because it was determined they would be of limited use due to the lack of data and high degree of uncertainty regarding the inputs to those analyses. Furthermore, an MIA was also not conducted because of the lack of “clear and convincing” evidence that

amended standards would be economically justified or result in significant conservation of energy. If DOE later determines that amended standards are warranted, these comments will be revisited.

V. Analytical Results and Conclusions

The following section addresses the results from DOE's analyses with respect to the considered energy conservation standards for UFHWSTs. It addresses the ELs examined by DOE and the projected site energy savings of each of these levels. As discussed previously, certain economic analyses were not conducted for this NOPD because it was determined they would be of limited value due to the lack of data and high degree of uncertainty of the inputs to those analyses.

A. National Impact Analysis

This section presents DOE's estimates of the site NES that would result from each of the ELs considered as potential amended standards.

1. Significance of Energy Savings

To estimate the energy savings attributable to potential amended standards for UFHWSTs, DOE compared their energy consumption under the no-new-standards case to their anticipated energy consumption under each EL. The savings are measured over the entire lifetime of equipment purchased in the 30-year period that begins in the year of anticipated compliance with amended standards (2025–2054). Table V.1 presents DOE's

projections of the site NES for each EL considered for UFHWSTs. The savings were calculated using the approach described in section IV.C of this document.

Table V.1 Cumulative National Energy Savings for UFHWSTs; 30 Years of Shipments (2025–2054)

	Efficiency Level	
	1	2
Site Energy (quads)	0.011	0.017
Percent Savings Over Baseline (%)	15%	26%

OMB Circular A-4³² requires agencies to present analytical results, including separate schedules of the monetized benefits and costs that show the type and timing of benefits and costs. Circular A-4 also directs agencies to consider the variability of key elements underlying the estimates of benefits and costs. For this proposed determination, DOE undertook a sensitivity analysis using 9 years, rather than 30 years, of equipment shipments. The choice of a 9-year period is a proxy for the timeline in EPCA for the review of certain energy conservation standards and potential revision of and compliance with such revised standards.³³ The review timeframe established in EPCA is generally

³² U.S. Office of Management and Budget, *Circular A-4: Regulatory Analysis* (Sept. 17, 2003) (Available at: https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/).

³³ Under 42 U.S.C. 6313(a)(6)(C)(i) and (iv), EPCA requires DOE to review its standards for covered ASHRAE equipment every 6 years, and it requires a 3-year period after any new standard is promulgated before compliance is required, except that in no case may any new standards be required within 6 years of the compliance date of the previous standards. If DOE makes a determination that amended standards are not needed, it must conduct a subsequent review within three years following such a determination. (42 U.S.C. 6313(a)(6)(C)(iii)(II)) Furthermore, if ASHRAE acts to amend ASHRAE Standard 90.1 for any of the enumerated equipment covered by EPCA, DOE is triggered to consider and adopt the amended ASHRAE levels, unless the Department has clear and convincing evidence to support more-stringent standard levels, which would result in significant additional energy savings and be technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(A)(ii)) If DOE adopts the amended ASHRAE levels, compliance with amended Federal energy conservation standards would be required either two or three years after the effective date of the ASHRAE Standard 90.1 amendments (depending upon the equipment

not synchronized with the equipment lifetime, equipment manufacturing cycles, or other factors specific to UFHWSTs. Thus, such results are presented for informational purposes only and are not indicative of any change in DOE’s analytical methodology. The NES sensitivity analysis results based on a 9-year analytical period are presented in Table V.2. The impacts are counted over the lifetime of UFHWSTs purchased in 2025 through 2033.

Table V.2 Cumulative National Energy Site Savings for UFHWSTs; 9 Years of Shipments (2025–2034)

	Efficiency Level	
	1	2
Site Energy (quads)	0.003	0.005
Percent Savings Over Baseline (%)	15%	26%

2. Net Present Value of Consumer Costs and Benefits

As discussed in section IV.D of this document, increasing the size of UFHWSTs could necessitate alterations to doorways and mechanical rooms in certain replacement installations in order to get an UFHWST to its installation destination. Further, due to significant uncertainties regarding the costs of these alterations and the lack of data indicating the likelihood of such alterations being required, at this time, DOE is unable to estimate typical installation costs of UFHWSTs. Therefore, any analysis conducted by

type in question). However, if DOE adopts more-stringent standards pursuant to the ASHRAE trigger, compliance with such standards would be required four years after publication of a final rule. (42 U.S.C. 6313(a)(6)(D)) As DOE is evaluating the need to amend the standards, the sensitivity analysis is based on the review timeframe associated with amended standards. While adding a 6-year review to the 3-year compliance period adds up to 9 years, DOE notes that it may undertake reviews at any time within the 6-year period and that the 3-year compliance date may yield to the 6-year backstop. A 9-year analysis period may not be appropriate given the variability that occurs in the timing of standards reviews and the fact that for some equipment, the compliance period may be something other than 3 years.

DOE regarding the LCC or PBP would be of limited value because of the lack of data and high degree of uncertainty of the inputs to those analyses, and as a result, DOE did not estimate the NPV of consumer costs and benefits.

B. Proposed Determination

After carefully considering the comments on the August 2019 RFI and the available data and information, DOE has tentatively determined that the energy conservation standards for UFHWSTs do not need to be amended, for the reasons explained in the paragraphs immediately following. DOE will consider all comments received on this proposed determination prior to issuing the next document in this rulemaking proceeding.

EPCA specifies that for any commercial and industrial equipment addressed under 42 U.S.C. 6313(a)(6)(A)(i), including UFHWSTs, DOE may prescribe an energy conservation standard more stringent than the level for such equipment in ASHRAE Standard 90.1 only if “clear and convincing evidence” shows that a more-stringent standard would result in significant additional conservation of energy and is technologically feasible and economically justified. (42 U.S.C. 6313(a)(6)(C)(i); 42 U.S.C. 6313(a)(6)(A)(ii)(II)) The “clear and convincing” evidentiary threshold applies both when DOE is triggered by ASHRAE action and when DOE conducts a six-year-lookback rulemaking, with the latter being the basis for the current proceeding.

Because an analysis of potential cost-effectiveness and energy savings first require an evaluation of the relevant technology, DOE first discusses the technological

feasibility of amended standards. DOE then evaluates the energy savings potential and cost-effectiveness of potential amended standards.

1. Significant Conservation of Energy

EPCA also mandates that DOE consider whether amended energy conservation standards for UFHWSTs would result in significant additional conservation of energy. (42 U.S.C. 6313(a)(6)(C)(i); 42 U.S.C. 6313(a)(6)(A)(ii)(II))

In the present case, DOE estimates that amended standards for UFHWST would result in energy savings of 0.011 quads at EL 1 and 0.017 quads at EL 2 (the max-tech level) over a 30-year analysis period (2025–2054), as realized by the connected hot-water supply boiler. However, as discussed in section IV.C.3 of this document, DOE has been unable to validate the results of the thermal loss model used for its analysis of energy savings, and consequently, there is considerable uncertainty regarding the accuracy and validity of the projected energy savings generated by that calculated model. Thus, DOE has tentatively determined that it lacks clear and convincing evidence that amended energy conservation standards for UFHWSTs would result in significant additional conservation of energy. (See results in Table V.1.)

2. Technological Feasibility

EPCA mandates that DOE consider whether amended energy conservation standards for UFHWSTs would be technologically feasible. (42 U.S.C. 6313(a)(6)(C)(i); 42 U.S.C. 6313(a)(6)(A)(ii)(II)) DOE has tentatively determined that increasing the thickness of insulation by up to 1 inch would improve the efficiency of UFHWSTs. As

discussed in section IV.B.1 of this document, this increase in insulation thickness can be achieved for jacketed UFHWSTs without resulting in a decrease in the insulative properties of the foam. However, the potential for a decrease in insulative value of foam as the thickness increases above 3 inches thick, which results from changes in foam density, adds uncertainty to the R-values achievable by higher levels of increased insulation thicknesses. Increasing the thickness of insulation by up to 1 inch is achievable with the same insulation processes currently used in commercially-available jacketed UFHWSTs, and, therefore, would be technologically feasible. (See section IV.A.3 of this document for further information.) Hence, DOE has tentatively determined that amended energy conservation standards for UFHWSTs would be technologically feasible.

3. Economic Justification

In determining whether a standard is economically justified, the Secretary must determine whether the benefits of the standard exceed its burdens, considering to the greatest extent practicable the seven statutory factors discussed previously (see section II.A of this document). (42 U.S.C. 6313(a)(6)(C)(i); 42 U.S.C. 6313(a)(6)(B)(ii)(I)-(VII))

One of those seven factors is the savings in operating costs throughout the estimated average life of the product in the type (or class) compared to any increase in the price, initial charges, or maintenance expenses of the products that are likely to result from the standard. (42 U.S.C. 6313(a)(6)(C)(i); 42 U.S.C. 6313(a)(6)(B)(ii)(II)) This factor is typically assessed using the LCC and PBP analysis, as well as the NPV.

However, as discussed in sections IV.D and V.A.2 of this document, DOE was unable to calculate the LCC, PBP, and NPV of amended standards, because significant uncertainties in the inputs to these analyses would result in significant uncertainties in the results. Consequently, DOE could not develop economic analyses that would provide “clear and convincing” evidence that amended standards are economically justified.

4. Summary

Based on the reasons stated in the foregoing discussion, DOE is proposing to determine that the energy conservation standards for unfired hot water storage tanks do not need to be amended, having initially determined that it lacks “clear and convincing” evidence that amended standards would be economically justified or result in significant additional conservation of energy. DOE will consider and respond to all comments received on this proposed determination in issuing any final determination.

VI. Procedural Issues and Regulatory Review

A. Review Under Executive Order 12866

The Office of Management and Budget (OMB) has determined that this proposed determination does not constitute a “significant regulatory action” under section 3(f) of Executive Order (E.O.) 12866, “Regulatory Planning and Review,” 58 FR 51735 (Oct. 4, 1993). Accordingly, this action was not subject to review under the Executive Order by the Office of Information and Regulatory Affairs (OIRA) at OMB.

B. Review Under the Regulatory Flexibility Act

The Regulatory Flexibility Act (5 U.S.C. 601 *et seq.*) requires preparation of an initial regulatory flexibility analysis (IRFA) for any rule that by law must be proposed for public comment, unless the agency certifies that the rule, if promulgated, will not have a significant economic impact on a substantial number of small entities. As required by E.O. 13272, “Proper Consideration of Small Entities in Agency Rulemaking,” 67 FR 53461 (August 16, 2002), DOE published procedures and policies on February 19, 2003, to ensure that the potential impacts of its rules on small entities are properly considered during the rulemaking process. 68 FR 7990. DOE has made its procedures and policies available on the Office of the General Counsel’s website (<http://energy.gov/gc/office-general-counsel>).

The Small Business Administration (SBA) considers a business entity to be a small business, if, together with its affiliates, it employs less than a threshold number of workers specified in 13 CFR part 121. The size standards and codes are established by the 2017 North American Industry Classification System (NAICS).

Unfired hot water storage tank manufacturers are classified under NAICS code 333318, “Other Commercial and Service Industry Machinery Manufacturing.” The SBA sets a threshold of 1,000 employees or fewer for an entity to be considered as a small business in this category. DOE has conducted a focused inquiry into small business manufacturers of the equipment covered by this rulemaking. The Department used available public information to identify potential small manufacturers. DOE accessed the

Compliance Certification Database³⁴ to create a list of companies that import or otherwise manufacture the unfired hot water storage tanks covered by this proposal. Using these sources, DOE identified a total of 48 distinct manufacturers of unfired hot water storage tanks. Of these manufacturers, DOE identified 37 manufacturers that are potential small businesses.

DOE reviewed this proposed determination under the provisions of the Regulatory Flexibility Act and the policies and procedures published on February 19, 2003. Because DOE is proposing not to amend standards for UFHWSTs, if adopted, the determination would not amend any energy conservation standards. On the basis of the foregoing, DOE certifies that the proposed determination, if adopted, would not have a “significant economic impact on a substantial number of small entities.” Accordingly, DOE has not prepared an IRFA for this proposed determination. DOE will transmit this certification and supporting statement of factual basis to the Chief Counsel for Advocacy of the Small Business Administration for review under 5 U.S.C. 605(b).

C. Review Under the Paperwork Reduction Act

This proposed determination, which proposes to determine that amended energy conservation standards for UFHWSTs are unneeded under the applicable statutory criteria, would impose no new informational or recordkeeping requirements.

³⁴ U.S. Department of Energy Compliance Certification Management System, available at: <https://www.regulations.doe.gov/ccms>.

Accordingly, OMB clearance is not required under the Paperwork Reduction Act. (44 U.S.C. 3501 *et seq.*)

D. Review Under the National Environmental Policy Act of 1969

DOE is analyzing this proposed action in accordance with the National Environmental Policy Act of 1969 (NEPA) and DOE's NEPA implementing regulations (10 CFR part 1021). DOE's regulations include a categorical exclusion for actions which are interpretations or rulings with respect to existing regulations. 10 CFR part 1021, subpart D, appendix A4. DOE anticipates that this action qualifies for categorical exclusion A4 because it is an interpretation or ruling in regard to an existing regulation and otherwise meets the requirements for application of a categorical exclusion. *See* 10 CFR 1021.410. DOE will complete its NEPA review before issuing the final action.

E. Review Under Executive Order 13132

E.O. 13132, "Federalism," 64 FR 43255 (August 10, 1999), imposes certain requirements on Federal agencies formulating and implementing policies or regulations that preempt State law or that have Federalism implications. The Executive Order requires agencies to examine the constitutional and statutory authority supporting any action that would limit the policymaking discretion of the States and to carefully assess the necessity for such actions. The Executive Order also requires agencies to have an accountable process to ensure meaningful and timely input by State and local officials in the development of regulatory policies that have Federalism implications. On March 14, 2000, DOE published a statement of policy describing the intergovernmental consultation process it will follow in the development of such regulations. 65 FR 13735. DOE has

examined this proposed determination and has tentatively determined that it would not have a substantial direct effect on the States, on the relationship between the national government and the States, or on the distribution of power and responsibilities among the various levels of government. EPCA governs and prescribes Federal preemption of State regulations as to energy conservation for the equipment that is the subject of this proposed determination. States can petition DOE for exemption from such preemption to the extent, and based on criteria, set forth in EPCA. (See 42 U.S.C. 6316(a) and (b); 42 U.S.C. 6297) As this proposed determination would not amend the standards for UFHWSTs, there is no impact on the policymaking discretion of the States. Therefore, no action is required by E.O. 13132.

F. Review Under Executive Order 12988

With respect to the review of existing regulations and the promulgation of new regulations, section 3(a) of E.O. 12988, “Civil Justice Reform,” imposes on Federal agencies the general duty to adhere to the following requirements: (1) eliminate drafting errors and ambiguity; (2) write regulations to minimize litigation; (3) provide a clear legal standard for affected conduct rather than a general standard, and (4) promote simplification and burden reduction. 61 FR 4729 (Feb. 7, 1996). Regarding the review required by section 3(a), section 3(b) of E.O. 12988 specifically requires that Executive agencies make every reasonable effort to ensure that the regulation: (1) clearly specifies the preemptive effect, if any; (2) clearly specifies any effect on existing Federal law or regulation; (3) provides a clear legal standard for affected conduct while promoting simplification and burden reduction; (4) specifies the retroactive effect, if any; (5) adequately defines key terms, and (6) addresses other important issues affecting clarity

and general draftsmanship under any guidelines issued by the Attorney General. Section 3(c) of Executive Order 12988 requires Executive agencies to review regulations in light of applicable standards in section 3(a) and section 3(b) to determine whether they are met, or it is unreasonable to meet one or more of them. DOE has completed the required review and determined that, to the extent permitted by law, this proposed determination meets the relevant standards of E.O. 12988.

G. Review Under the Unfunded Mandates Reform Act of 1995

Title II of the Unfunded Mandates Reform Act of 1995 (UMRA) requires each Federal agency to assess the effects of Federal regulatory actions on State, local, and Tribal governments and the private sector. Pub. L. 104-4, sec. 201 (codified at 2 U.S.C. 1531). For a proposed regulatory action likely to result in a rule that may cause the expenditure by State, local, and Tribal governments, in the aggregate, or by the private sector of \$100 million or more in any one year (adjusted annually for inflation), section 202 of UMRA requires a Federal agency to publish a written statement that estimates the resulting costs, benefits, and other effects on the national economy. (2 U.S.C. 1532(a), (b)) The UMRA also requires a Federal agency to develop an effective process to permit timely input by elected officers of State, local, and Tribal governments on a proposed “significant intergovernmental mandate,” and requires an agency plan for giving notice and opportunity for timely input to potentially affected small governments before establishing any requirements that might significantly or uniquely affect them. On March 18, 1997, DOE published a statement of policy on its process for intergovernmental consultation under UMRA. 62 FR 12820. DOE’s policy statement is also available at https://energy.gov/sites/prod/files/gcprod/documents/umra_97.pdf.

DOE examined this proposed determination according to UMRA and its statement of policy and determined that the proposed determination does not contain a Federal intergovernmental mandate, nor is it expected to require expenditures of \$100 million or more in any one year by State, local, and Tribal governments, in the aggregate, or by the private sector. As a result, the analytical requirements of UMRA do not apply.

H. Review Under the Treasury and General Government Appropriations Act, 1999

Section 654 of the Treasury and General Government Appropriations Act, 1999 (Pub. L. 105-277) requires Federal agencies to issue a Family Policymaking Assessment for any rule that may affect family well-being. This proposed determination would not have any impact on the autonomy or integrity of the family as an institution. Accordingly, DOE has concluded that it is not necessary to prepare a Family Policymaking Assessment.

I. Review Under Executive Order 12630

Pursuant to E.O. 12630, “Governmental Actions and Interference with Constitutionally Protected Property Rights,” 53 FR 8859 (March 15, 1988), DOE has determined that this proposed determination would not result in any takings that might require compensation under the Fifth Amendment to the U.S. Constitution.

J. Review Under the Treasury and General Government Appropriations Act, 2001

Section 515 of the Treasury and General Government Appropriations Act, 2001 (44 U.S.C. 3516 note) provides for Federal agencies to review most disseminations of information to the public under information quality guidelines established by each agency

pursuant to general guidelines issued by OMB. OMB's guidelines were published at 67 FR 8452 (Feb. 22, 2002), and DOE's guidelines were published at 67 FR 62446 (Oct. 7, 2002). Pursuant to OMB Memorandum M-19-15, Improving Implementation of the Information Quality Act (April 24, 2019), DOE published updated guidelines which are available at:

<https://www.energy.gov/sites/prod/files/2019/12/f70/DOE%20Final%20Updated%20IQA%20Guidelines%20Dec%202019.pdf>. DOE has reviewed this NOPD under the OMB and DOE guidelines and has concluded that it is consistent with applicable policies in those guidelines.

K. Review Under Executive Order 13211

E.O. 13211, "Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use," 66 FR 28355 (May 22, 2001), requires Federal agencies to prepare and submit to OIRA at OMB, a Statement of Energy Effects for any proposed significant energy action. A "significant energy action" is defined as any action by an agency that promulgates or is expected to lead to promulgation of a final rule, and that: (1) is a significant regulatory action under Executive Order 12866, or any successor Executive Order; and (2) is likely to have a significant adverse effect on the supply, distribution, or use of energy, or (3) is designated by the Administrator of OIRA as a significant energy action. For any proposed significant energy action, the agency must give a detailed statement of any adverse effects on energy supply, distribution, or use should the proposal be implemented, and of reasonable alternatives to the action and their expected benefits on energy supply, distribution, and use.

This proposed determination, which does not propose to amend energy conservation standards for UFHWSTs, is not a significant regulatory action under Executive Order 12866. Moreover, it would not have a significant adverse effect on the supply, distribution, or use of energy, nor has it been designated as a significant energy action by the Administrator at OIRA. Therefore, it is not a significant energy action, and accordingly, DOE has not prepared a Statement of Energy Effects.

L. Review Under the Information Quality Bulletin for Peer Review

On December 16, 2004, OMB, in consultation with the Office of Science and Technology Policy (OSTP), issued its Final Information Quality Bulletin for Peer Review (the Bulletin). 70 FR 2664 (Jan. 14, 2005). The Bulletin establishes that certain scientific information shall be peer reviewed by qualified specialists before it is disseminated by the Federal Government, including influential scientific information related to agency regulatory actions. The purpose of the bulletin is to enhance the quality and credibility of the Government's scientific information. Under the Bulletin, the energy conservation standards rulemaking analyses are "influential scientific information," which the Bulletin defines as "scientific information the agency reasonably can determine will have, or does have, a clear and substantial impact on important public policies or private sector decisions." *Id.* at 70 FR 2667.

In response to OMB's Bulletin, DOE conducted formal peer reviews of the energy conservation standards development process and the analyses that are typically used and has prepared Peer Review report pertaining to the energy conservation standards

rulemaking analyses.³⁵ Generation of this report involved a rigorous, formal, and documented evaluation using objective criteria and qualified and independent reviewers to make a judgment as to the technical/scientific/business merit, the actual or anticipated results, and the productivity and management effectiveness of programs and/or projects. DOE has determined that the peer-reviewed analytical process continues to reflect current practice, and the Department followed that process for considering amended energy conservation standards in the case of the present action.

VII. Public Participation

A. Participation in the Webinar

The time and date of the webinar are listed in the **DATES** section at the beginning of this document. Webinar registration information, participant instructions, and information about the capabilities available to webinar participants will be published on DOE's website:

https://www1.eere.energy.gov/buildings/appliance_standards/standards.aspx?productid=36&action=viewlive. Participants are responsible for ensuring their systems are compatible with the webinar software.

B. Procedure for Submitting Prepared General Statements for Distribution

Any person who has an interest in the topics addressed in this proposed rulemaking, or who is representative of a group or class of persons that has an interest in

³⁵ "Energy Conservation Standards Rulemaking Peer Review Report" (2007) (Available at: <https://energy.gov/eere/buildings/downloads/energy-conservation-standards-rulemaking-peer-review-report-0>).

these issues, may request an opportunity to make an oral presentation at the webinar. Such persons may submit requests to speak by email to the Appliance and Equipment Standards Program, *ApplianceStandardsQuestions@ee.doe.gov*. Persons who wish to speak should include with their request a computer file in WordPerfect, Microsoft Word, PDF, or text (ASCII) file format that briefly describes the nature of their interest in this rulemaking and the topics they wish to discuss. Such persons should also provide a daytime telephone number where they can be reached.

Persons requesting to speak should briefly describe the nature of their interest in this proposed determination and provide a telephone number for contact. DOE requests persons selected to make an oral presentation to submit an advance copy of their statements at least two weeks before the webinar. At its discretion, DOE may permit persons who cannot supply an advance copy of their statement to participate, if those persons have made advance alternative arrangements with the Building Technologies Office. As necessary, requests to give an oral presentation should ask for such alternative arrangements.

C. Conduct of the Webinar

DOE will designate a DOE official to preside at the webinar and may also use a professional facilitator to aid discussion. The meeting will not be a judicial or evidentiary-type public hearing, but DOE will conduct it in accordance with section 336 of EPCA (42 U.S.C. 6306). A court reporter will be present to record the proceedings and prepare a transcript. DOE reserves the right to schedule the order of presentations

and to establish the procedures governing the conduct of the webinar. There shall not be discussion of proprietary information, costs or prices, market share, or other commercial matters regulated by U.S. anti-trust laws. After the webinar and until the end of the comment period, interested parties may submit further comments on the proceedings and any aspect of the proposed determination.

The webinar will be conducted in an informal, conference style. DOE will present summaries of comments received before the webinar, allow time for prepared general statements by participants, and encourage all interested parties to share their views on issues affecting this proposed determination. Each participant will be allowed to make a general statement (within time limits determined by DOE), before the discussion of specific topics. DOE will permit, as time permits, other participants to comment briefly on any general statements.

At the end of all prepared statements on a topic, DOE will permit participants to clarify their statements briefly and comment on statements made by others. Participants should be prepared to answer questions by DOE and by other participants concerning these issues. DOE representatives may also ask questions of participants concerning other matters relevant to this proposed determination. The official conducting the webinar will accept additional comments or questions from those attending, as time permits. The presiding official will announce any further procedural rules or modification of the above procedures that may be needed for the proper conduct of the webinar.

A transcript of the webinar will be included in the docket, which can be viewed as described in the *Docket* section at the beginning of this NOPD. In addition, any person may buy a copy of the transcript from the transcribing reporter.

D. Submission of Comments

DOE will accept comments, data, and information regarding this proposed determination no later than the date provided in the **DATES** section at the beginning of this proposed determination. Interested parties may submit comments, data, and other information using any of the methods described in the **ADDRESSES** section at the beginning of this document.

Submitting comments via <https://www.regulations.gov>. The <https://www.regulations.gov> webpage will require you to provide your name and contact information. Your contact information will be viewable to DOE Building Technologies staff only. Your contact information will not be publicly viewable except for your first and last names, organization name (if any), and submitter representative name (if any). If your comment is not processed properly because of technical difficulties, DOE will use this information to contact you. If DOE cannot read your comment due to technical difficulties and cannot contact you for clarification, DOE may not be able to consider your comment.

However, your contact information will be publicly viewable if you include it in the comment itself or in any documents attached to your comment. Any information that

you do not want to be publicly viewable should not be included in your comment, nor in any document attached to your comment. Otherwise, persons viewing comments will see only first and last names, organization names, correspondence containing comments, and any documents submitted with the comments.

Do not submit to <https://www.regulations.gov> information for which disclosure is restricted by statute, such as trade secrets and commercial or financial information (hereinafter referred to as Confidential Business Information (CBI)). Comments submitted through <https://www.regulations.gov> cannot be claimed as CBI. Comments received through the website will waive any CBI claims for the information submitted. For information on submitting CBI, see the Confidential Business Information section.

DOE processes submissions made through <https://www.regulations.gov> before posting. Normally, comments will be posted within a few days of being submitted. However, if large volumes of comments are being processed simultaneously, your comment may not be viewable for up to several weeks. Please keep the comment tracking number that <https://www.regulations.gov> provides after you have successfully uploaded your comment.

Submitting comments via email. Comments and documents submitted via email also will be posted to <https://www.regulations.gov>. If you do not want your personal contact information to be publicly viewable, do not include it in your comment or any accompanying documents. Instead, provide your contact information in a cover letter. Include your first and last names, email address, telephone number, and optional mailing

address. With this instruction followed, the cover letter will not be publicly viewable as long as it does not include any comments

Include contact information each time you submit comments, data, documents, and other information to DOE. No telefacsimiles (faxes) will be accepted.

Comments, data, and other information submitted to DOE electronically should be provided in PDF (preferred), Microsoft Word or Excel, WordPerfect, or text (ASCII) file format. Provide documents that are not secured, that are written in English, and that are free of any defects or viruses. Documents should not contain special characters or any form of encryption and, if possible, they should carry the electronic signature of the author.

Campaign form letters. Please submit campaign form letters by the originating organization in batches of between 50 to 500 form letters per PDF or as one form letter with a list of supporters' names compiled into one or more PDFs. This reduces comment processing and posting time.

Confidential Business Information. Pursuant to 10 CFR 1004.11, any person submitting information that he or she believes to be confidential and exempt by law from public disclosure should submit via email two well-marked copies: one copy of the document marked "confidential" including all the information believed to be confidential, and one copy of the document marked "non-confidential" with the information believed

to be confidential deleted. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

It is DOE's policy that all comments may be included in the public docket, without change and as received, including any personal information provided in the comments (except information deemed to be exempt from public disclosure).

E. Issues on Which DOE Seeks Comment

Although DOE welcomes comments on any aspect of this proposed determination, DOE is particularly interested in receiving comments and views of interested parties concerning the following issues:

- (1) DOE requests data and information related to achievable R-values of polyurethane foam insulation on jacketed UFHWSTs at thicknesses above 3 inches. DOE also seeks comment on its understanding of the difficulties associated with applying more than 3 inches of foam to jacketed UFHWSTs.
- (2) DOE seeks comment on the considered efficiency levels analyzed for UFHWSTs. Additionally, DOE seeks comment on its assumption that polyurethane foam has an R-value per inch of 6.25, up to a maximum thickness of 3 inches.
- (3) DOE requests comment on the inputs and assumptions used in its engineering analysis. In particular, DOE requests input on its choice of representative volumes, its assumptions about the typical coverage of various insulation materials, and its estimated R-values for each insulation material at each EL considered.

- (4) DOE requests comment on the appropriateness of its assumption regarding the use of a constant internal water temperature of 140 °F.
- (5) DOE requests comment on its assumption regarding the typical ambient temperatures for UFHWSTs installed indoors and outdoors.
- (6) DOE requests comment on its assumption that 10 percent of all UFHWST would be installed outdoors. DOE requests information on the typical capacities and R-values of outdoor equipment.
- (7) DOE requests comment on its assumption that outdoor installations would be limited to climate zones 1A, 2A, and 2B. DOE requests information or data on the fraction of installations that occur within these, or other, climate zones.
- (8) DOE requests comment on its Tank Thermal Loss Model.
- (9) DOE requests data and information which can be used to estimate installation costs of UFHWSTs with modified dimensions.
- (10) DOE requests information and data characterizing the types of buildings where installation difficulties are likely to occur and to lead to increased installation cost, as well as the frequency with which such installation problems may arise.
- (11) DOE requests information and data characterizing the average installation costs for UFHWSTs at all different storage volumes.
- (12) DOE requests information and data characterizing the circumstances that would drive the decision to potentially restructure existing building spaces, including doorways and mechanical rooms, when installing a replacement UFHWST. For example, is the decision driven by a minimum building code requirement for door openings?

(13) DOE requests comments generally regarding its stock analysis for UFHWSTs.

(14) DOE requests comment regarding its assumption that there would be only one UFHWST per building.

(15) DOE requests comment regarding its disaggregation of UFHWST stock by sector.

(16) DOE requests comment on its assumption that UFHWSTs are not used for industrial process hot water storage.

(17) DOE requests comment on its assumption of a 12-year lifetime for UFHWSTs similar to commercial electric hot water storage tanks.

(18) DOE requests comment on its use of *AEO 2021* trends as a scaler to project shipments to new construction.

(19) DOE requests comment on its distribution of shipments by storage volume, and on its assumption that the distribution of shipments by storage volume does not change over time.

(20) DOE requests comment regarding its applied efficiency distribution that 99 percent of all units sold are currently at baseline (R-12.5)

VIII. Approval of the Office of the Secretary

The Secretary of Energy has approved publication of this notification of proposed determination.

Signing Authority

This document of the Department of Energy was signed on June 3, 2021, by Kelly Speakes-Backman, Principal Deputy Assistant Secretary and Acting Assistant Secretary for Energy Efficiency and Renewable Energy, pursuant to delegated authority from the Secretary of Energy. That document with the original signature and date is maintained by DOE. For administrative purposes only, and in compliance with requirements of the Office of the Federal Register, the undersigned DOE Federal Register Liaison Officer has been authorized to sign and submit the document in electronic format for publication, as an official document of the Department of Energy. This administrative process in no way alters the legal effect of this document upon publication in the *Federal Register*.

Signed in Washington, DC, on June 3, 2021.

Treena V. Garrett,

Federal Register Liaison Officer,

U.S. Department of Energy.